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MODEL AIRPLANE NEWS

48120 December 1993

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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MODEL AIRPLANE NEWS

FEATURES

ON THE COVER: *Larry Alles of Flemington, NJ, flew this scratch-built 40-percent-scale PT-17 at the '93 Rally of Giants (see "Air Scoop"). (Photo by Gerry Yarrish.) Insert—Eugene Martin's all-wood F4D-1 Skyray.*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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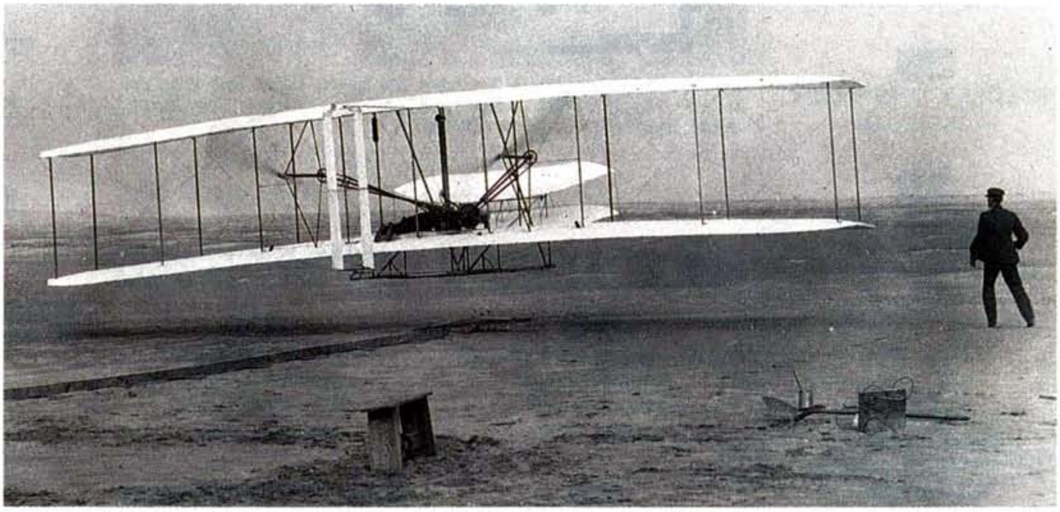
EDITORIAL

TOM ATWOOD

THE CENTURY'S GREATEST MODELERS

December '93 marks the 90th anniversary of the Wright brothers' supreme achievement—the demonstration of powered, controlled and sustained flight by a manned aircraft. More than a few contemporaries were racing to beat the Wright brothers to this goal, but it was the Wrights who demonstrated an aircraft design that had control in all three axes and that became the standard by which further progress was measured.

It has been estimated that the Wright brothers performed approximately 2,000 glider flights before attempting a powered flight. In many flights, the gliders were flown as kites—essentially tethered models flown in slope lift. To perfect their designs, the Wright brothers first reviewed the work of other experimenters. If the answers they sought were not forthcoming, they simply invented whatever they needed. They built a wind tunnel to test different airfoils and wing configurations. They invented their own theory of propellers based on tables of air pressures derived from their wind-tunnel experiments. They designed and built their own aircraft engine. It is an amazing story, no matter how you look at it.



December 17, 1903: Orville Wright's first attempt at powered flight. Wilbur stands to the right of the plane.

Many may have overlooked this fact, but the Wright brothers were really consummate modelers—arguably the greatest scratch-builders of this century. They possessed mechanical genius, unwavering confidence in the feasibility of their project, a methodical approach to identifying and solving problems and immense patience. These are qualities that benefit anyone who sets his or her mind on a particular goal—qualities that many of us could use more of today. We salute the Wright brothers on the 90th anniversary of their first flight.

Incidentally, if you would like to get an eyeful of the early Wright brothers' work, I recommend a volume titled, "Wind and Sand, The Story of the Wright Brothers at Kitty Hawk," by Lynanne Wescott and Paula Degen (organized, edited and designed by the Eastern National Park and Monument Association, published in paperback by Eastern National, and in hardcover by Harry N. Abrams). This book tells the Wrights' story through their own words and photographs. The hardcover edition is packed with high-quality reproductions of glass-plate photographs of the Wrights' early aircraft, shown in a variety of flight modes. To obtain a hardcover version of this collectors' item (I understand that a limited number remain in stock), call the Eastern National Park and Monument Association at (919) 441-6181. It could make a nice holiday gift.

FIRST FLIGHT REVISITED

We are pleased to bring you a new look at the first powered flight of the Wright brothers. Authored by Major William J. O'Dwyer, USAF Reserve (Ret.), "Kitty Hawk Revisited" is based on documentation that, to the best of our knowledge, has not seen the light of day until now. Who is O'Dwyer? A former USAF flight instructor, he has logged several thousand hours of military and civilian flight time. For 31 years, O'Dwyer has been deeply involved in researching the history of early flight. He has published a book on Gustav Whitehead, Connecticut's early aviation pioneer, and has been cited internationally by such people as John W.R. Taylor (of "Jane's All the World's Aircraft" fame) in a volume titled "The History of Aviation" (Siglach, German edition). O'Dwyer was a NASA Liaison/Courier from 1984 to '85 (lunar-rock exhibit in Germany), was co-founder of the Whitehead Air Museum in Germany and assisted the late professor Hermann Oberth—a German pioneer of rocket science—in the preparation of his rocket history museum. O'Dwyer's article offers an unexpected twist to the most famous story of early aviation. ■

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," ***Model Airplane News***, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

SOUNDING OFF

After reading comments in "Airwaves" on noise that stated that really quiet airplanes should use a particular Japanese tuned pipe, I have some comments to make for the sake of perspective. For my part, I take issue with the statement that F3A or any other pattern event led us down the sound-reduction path. It's just not so. The only sound level they had to meet was 96dB at 9 feet. In the meantime, a number of manufacturers, including Davis Diesel Development Co., have invested time and money in perfecting mufflers and quiet pipes, all of which have helped advance the hobby in the sound arena.

There's more to the story than just slapping a big prop onto a plane and supporting it with a tuned pipe. Engines are being destroyed by bad information or overly simplistic approaches. When there were fewer choices of propeller pitch, there were fewer mistakes for the modeler to make. Less than five years ago, you could buy an 11x7, 11x7.5 or an 11x8 for your .61. Whatever you picked, you could dial in the proper performance. Today, you can get an 11-inch prop with a choice of pitches that range from 7 through 13. If you think these would all load the engine the same, you could also believe that thunder curdles milk.

A prominent modeler told me recently that you need at least 12 to 14 inches of pitch for best pattern performance. The engine under discussion was a 4.2ci monster. I tried to explain that high pitch was like overdrive and low pitch was like low gear. You can only increase diameter to a point, after which the "centrifugal loading" of the prop will cause the power to swing, e.g., lose power in a climb and speed up in a dive. On the other hand, pitch increases are an air drag—more like a governor. Thus, pitch increases tend to hold speed more constant even as they load the engine.

Although quieting engines is important to save flying fields, is it realistic to assume we can change how the average modeler feels about things he is comfortable with? More noise means more power. Did you ever see anything go really fast that didn't make a big noise? Let's face it, guys: we like making noise. We've been doing it all our lives from the time we were babies. How else could we get anyone's attention?

However, if you want to quiet your engine, the after-market producers offer some very good mufflers and some bad ones. It's up to you—the modeler—to become informed about the virtues of the available products. You'll have to screen through the self-proclaimed virtues and get to the heart of the matter. Read, become informed, find out who said what and about the credentials of those offering opinions. Speak to other modelers who use various mufflers, but remember: one weekend does not tell the whole story. Products must last for months and years, and do so without harming the engine.

Keep in mind that glow fuels are not all equal. Some will tend to run your engine on the hot side. A good muffler retains some heat at idle to help your engine run, but at higher throttle settings, it does not offer excessive back pressure that could cause your engine to run hot. The combination of a muffler with high back pressure and a low-oil fuel can be rather disastrous to a model engine. So, remember, muffled engines need good oil packages.

If someone says there is nothing available on the market that has value as a quiet muffler, that person is uninformed. There are good products available to do the job. The informed modeler will find the right product without having to reinvent the wheel. But remember, there's no free lunch; you pay for what you get; a fool and his money are soon parted; there's no substitute for value; and only the educated consumer recognizes true value.

BOB DAVIS
Milford, CT

Thanks, Bob, for your comments. In defense of the pattern guys, one can't deny the relative quiet at pattern meets these days! Even if pattern has been only one segment of the hobby, they have quieted their planes and, I think, deserve credit for what they have done.

(Readers will recognize Bob Davis as the owner of Davis Diesel Development Co. and developer of the Soundmaster muffler and quiet pipe line—viewed as among the best by many.) TA

WHAT'S IN A NAME?

After reading an article in your magazine called "The Lomcevak," I would like to answer the question that ended the article.

For years, I kept reading in magazines about the Lomcevak, and it bothered me greatly that it was spelled wrong. So this time, here it goes.

I am a 52-year-old Czech who lives in Australia and who has been flying model airplanes for 25 years now. I hope this makes me as good an authority as anyone to describe what the Lomcevak means. First, the correct spelling should be Lomcova'k [the "a" is pronounced like the "a" in bake]. Lomcova'k comes from the verb "lomcovati," which means a violent shaking, i.e., the wind shaking a tree to the point of ripping it out of the ground. The Lomcova'k is also the name of a very stiff drink, such as 80- to 85-proof Slivovitz (plum brandy). It will shake you up very violently, believe me.

As for the name of the maneuver described in your magazine, I can't think of a better word for it. Under no circumstances does Lomcova'k mean break a leg, although it may happen after you've had a few Lomcova'ks (drinks, that it). A headache and a hangover you will have most definitely, I guarantee that. I hope that this letter will clear all the misconceptions about the Lomcova'k.

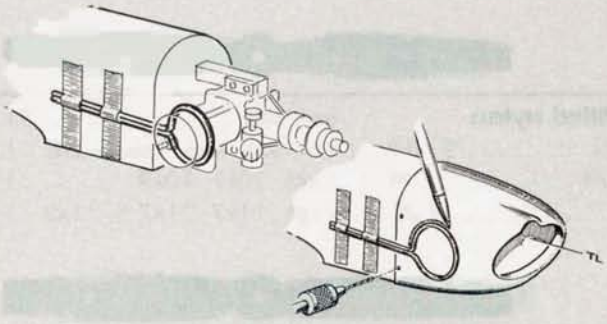
F. JAKUBEC
Vincentia, Australia

Frank, thanks for the information regarding the Lomcova'k. It sounds as if you're familiar with the maneuver and its history. I guess this is one word that however it is spelled, doesn't lose too much in the translation. GY

HINTS & KINKS

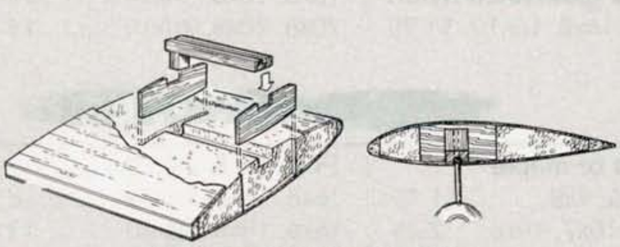
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News,* 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



ACCURATE COWL CUTOUT

Bend no. 12 or no. 14 electrical wire around the engine case, and tape it securely to the fuselage side. Remove the engine without disturbing the wire. Slip the cowl into place, taking care to center it vertically on the thrust line. Fit the cowl-mounting screws, and trace around the wire with a felt-tip pen. Remove the wire from the fuselage, and cut out the hole for the cylinder head. Repeat this procedure for the muffler exit hole if necessary. ***Ed Decatrel, Glen Oaks, NY***

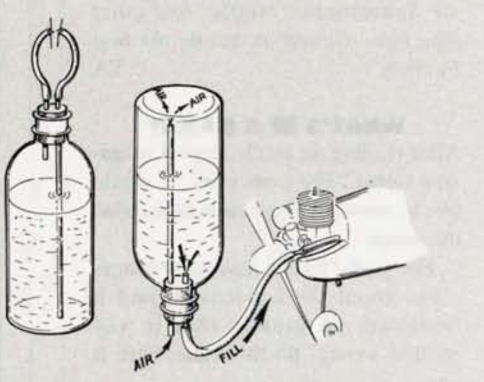


SECURE GEAR BLOCKS

This cured gear block tear-out on a Sig Kougar will work with any foam wing. Epoxy a rectangular piece of birch ply or, better still, a pair of short ribs into slots that have been cut into the foam-core as shown. Epoxy the landing-gear block into the notches with the vertical block glued to the side of the appropriate rib. Now the block no longer relies on just foam to hold it in place, and the landing-gear loads are transferred to the wing skins. ***Greg Poppel, Columbus, OH***

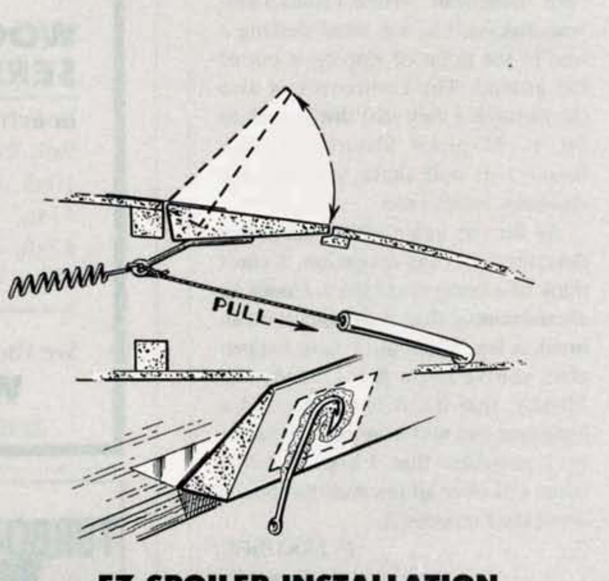
COX THROTTLE CONNECTION

To make a throttle arm, thread a paper clip through the holes in the throttle snap ring (as shown) and wrap the paper clip tightly to secure it. Slit the silicone fuel-line retainer (b) using the point of a blade, push it onto the arm and pierce it with a pin. Push the .032-inch music wire pushrod down through the tube, and then complete the retaining Z-bend. ***Daniel H. Simenson, Oak Harbor, WA***



NO-COST FUEL FILLER

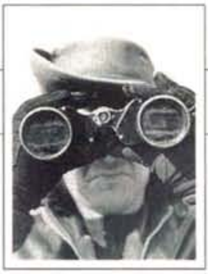
Force two pieces (one long and one short) of Nyrod tube through a rubber bung (available at a pharmacy or a hobby shop) as shown. Fill a large plastic bottle with fuel, and tightly insert the bung in the top of the bottle. Attach one end of a fuel line to the short tube and the other end to the fill line on the model. If the bottle is held inverted over the model (as shown), it will fill the tank at a surprising speed. Remember, the higher you hold the bottle, the faster it will fill. To seal the fuel bottle, simply plug the fuel line onto the vent tube. ***Craig Watkins, Coventry, RI***



EZ SPOILER INSTALLATION

The spoiler blade is a piece of trailing-edge stock that has been covered and hinged to the upper wing surface with a strip of covering film strip or Mylar tape. The actuating arm is a fishhook that's glued to the blade and secured with a piece of fiberglass tape. The pull cord should be non-stretch dial cord that has been run through a nylon tube. The spoilers are held closed with a rubber band or a spring. Install the spoilers well outboard of the stabilizer tips so that the tail won't be in the spoiler wake. If you have a "floater" or a clean, slick model and a small field, try them; they're the greatest thing since the wheel. ***Jim Simpson, Rio Rancho, NM***

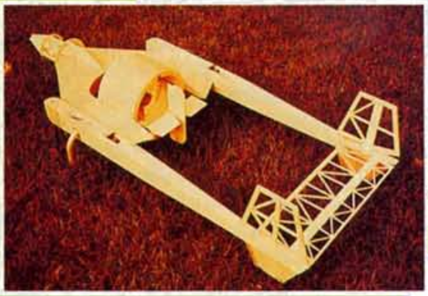
AIR SCOOP



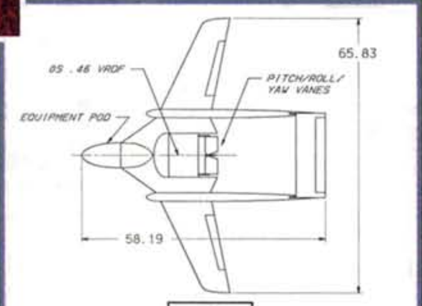
CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

THE VERTIGO —a sport R/C VTOL



We are proud to announce that *Model Airplane News*—with the help of Tom Hunt of Grumman Aerospace (shown next to the Vertigo)—will be publishing what we believe is the first fully "transitionable" sport VTOL R/C aircraft. With off-the-shelf parts, it can be built and flown by any accomplished R/C modeler. The prototype of the Vertigo is shown here; it has since been modified to perfect its flight capabilities. The model has made several flights during which it made the transition from hover to horizontal flight and back for a helicopter-like landing. It has been designed to be affordable, simple to build and reliable in the air. Will you be the first at your field to fly a Vertigo?



Here are some of the specifications of the prototype. (We aren't revealing the final design until we publish the construction article.) You'll need a programmable radio because the model requires V-tail-type mixing, fully adjustable rates, reversing and programmable cross-mixing. The 9-pound (wet) prototype has a 65.83-inch wingspan and a 645-square-inch wing area. It provides over 10 pounds of static thrust with an O.S. .46 VRDF engine spinning a shrouded 9x5 Zinger or Rev-Up prop. A small electric motor (an Astro Flight 020 is shown here) turns a lead screw with the assistance of a Master Airscrew gearbox to tilt the engine-bearing nacelle. In hover, the beast consumes 2 ounces of Cool Power per minute, and movable vanes mounted below the fan offer control of the ship. After the transition to horizontal flight, conventional ailerons and elevator take over.

Tom Hunt poses with the Vertigo.

Thanks to Tom Hunt for his pioneering efforts in this area—which will now bring VTOL technology and performance into the realm of possibility for modelers everywhere. Look for the construction article in a future *Model Airplane News* issue.

Cecil B. DeNicky

This is Nick Ziroli Jr. mounting a JVC VHS-C video mini-cam in his trusty old Zenoah G-62-powered, Futaba-guided Ziroli Zero. Like his father, Nicky is a fantastic pilot. Flying the Zero as long as he has, he has become one with the machine. To watch Nicky and the Zero go through their paces is a real treat. Anyway, I've been told that things are still in the refinement stages, but already, there's some great footage, including air-to-air, gun-sight-type stuff that will probably show up on a future Prop Wash video by Werner Kopf. Stay tuned.

What Next? Ride-in R/C?

Our associate editor, Gerry Yarrish, took these fine photos of this 40-percent-scale Stearman PT-17 when he attended the '93 IMAA Rally of Giants held in Westfield, MA, this past September. Gerry told me, "Believe me, Chris, I automatically get into the large-airplane frame of mind whenever I go to an IMAA meet. My perceptions of large, however, were jolted to new heights when I saw Larry Alles' monster biplane." Larry doubled Nick Ziroli's PT-17 plans. Gerry added, "The sound of the 18hp Quadra Aerrow 200 engine with its homemade muffler only added to the illusion. If you closed your eyes, it sounded as if a full-scale plane had flown by!" Gerry, some would say it had! This thing has a 13-foot span—only about 2.5 to 3 feet less than the bottom wingspan of a full-scale S-1 Pitts!

Blatantly annoy-ed with my limited ability to understand, Gerry continued, "When Larry pushed the model to the flight line, you got a powerful indication of this huge model's mass. Starting the engine by hand with its 30x8 Zinger prop" (did it take both hands and body weight, Gerry?) "really didn't look any more dangerous than starting any gasoline-powered model. When it roared to life, the prop blast made the guy holding the tail look like a wing walker with pants, shirt and hair flapping in a hurricane. It was the biggest, most beautiful model I ever saw." What's next, Gerry? Will modelers be climbing into cockpits with their transmitters? "Shut up, Chris, you plebeian!" Gerry replied. I'll admit, it sure is beautiful.

Keep the pressure on!

Davis Model Products' new Clip-Its is one of those "why didn't I think of that?" type of item. Never again will your engine go lean and quit because the muffler's pressure line has become disconnected. These spring-steel, fuel-tubing clamps are miniature versions of the auto-hose clamps found on the English sports cars of the '60s and '70s. As you can see from the photo, a large amount of tension is being applied, yet the

tube remains fixed to the fitting. I can't imagine any in-flight circumstances that would rival this test, short of your engine falling out. Even then, the Clip-Its might keep the engine dangling from the firewall! Isn't that a humorous image? Clip-Its clamps come in two sizes and are a must with positive-pressure, fuel-feed systems like those found on YS engines. For more information, contact Davis Model Products, P.O. Box 141, Milford, CT 06460; (203) 877-1670.

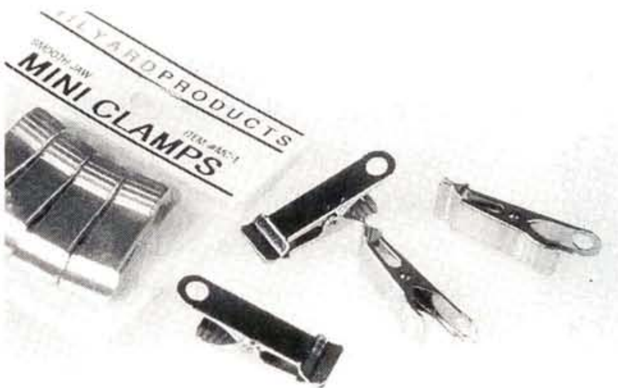
Efficiency in the Field

If you hate dragging a heavy, steamer-trunk-size field box to your flying sessions, have a look at Gene Barton's new Flightline Tote. This space-saver tote really cuts things to the essentials. Made of red anodized aluminum, the tote features a tool rack, a machined handle with a rubber grip, spare glow-plug holes, Velcro®-brand-fastener straps for batteries and fuel tanks (round or square), plus provisions for an air pump, a fuel pump and a starter. Price: $39.50. Contact Gene Barton, 11640 Salinez, Garden Grove, CA 92643; (714) 539-9142.

HOW TO:

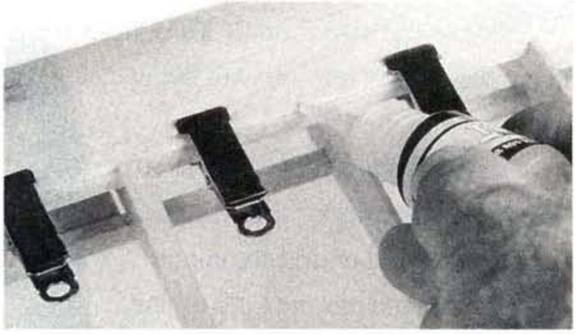
RANDY RANDOLPH

NEW TOOLS THAT MAKE MODELING EASIER

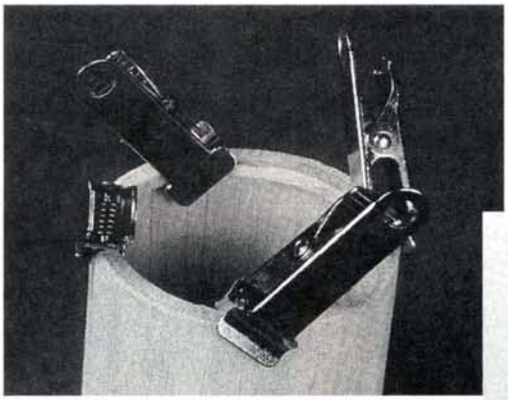


Mini clamps with smooth jaws are very handy. They can reach places that other clamps—including clothespins (the old favorite)—just won't grab, and they're inexpensive!

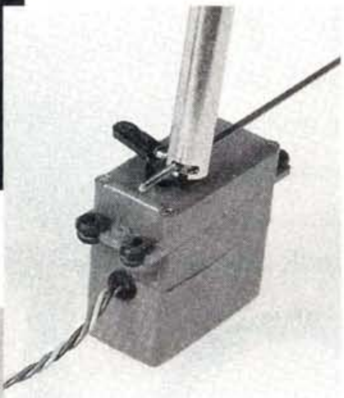
EVERY NOW AND then, a new tool comes along that solves one of those irritating little problems that we encounter in everyday building and flying. Three such tools from Hilyard Products (857 Nick Springs Rd., El Dorado, AR 71730)—a mini clamp, a T-handle wrench and a flat connector wrench—should find a place on every workbench.



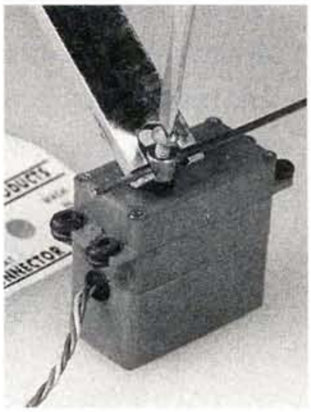
Applying leading-edge sheeting is much easier with these small clamps because they allow the glue to wick between their jaws. They provide enough pressure to hold the sheeting in place, but they won't dent even the softest wood.



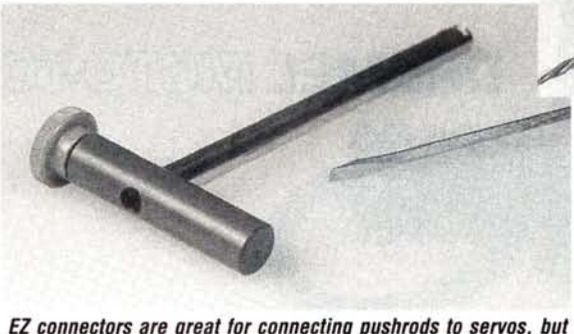
Forming and holding sheet balsa around formers while you're gluing is one of those "not enough hands" jobs. These mini clamps fit easily into small cowls and still leave room for your fingers.



The T-handle wrench slips over the connector and locks the pushrod in place, while a screwdriver slips down the center of the tool to tighten the setscrew. The wrench has a 6-inch shaft, so it can reach buried servos.



The flat connector wrench is made for tightening connectors on servos that are more easily accessible. It slips onto and holds the pushrod in position and allows room for tightening the setscrew.

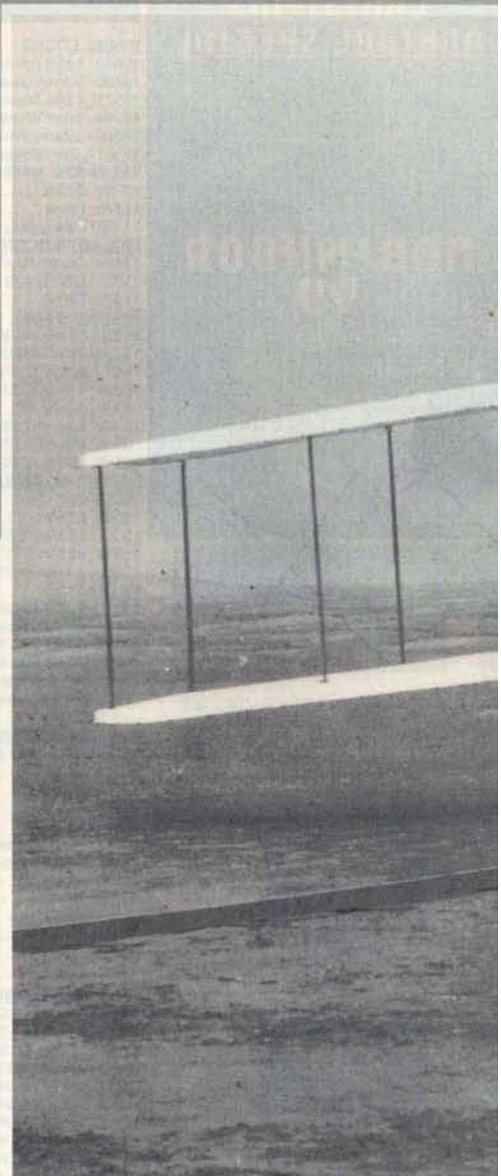


EZ connectors are great for connecting pushrods to servos, but making adjustments and tightening setscrews deep in a fuselage can be a real headache. This T-handle connector wrench is truly a blessing.

Did Orville or Wilbur make the first powered flight?

The Dawn of Aviation

Kitty Hawk Revisited



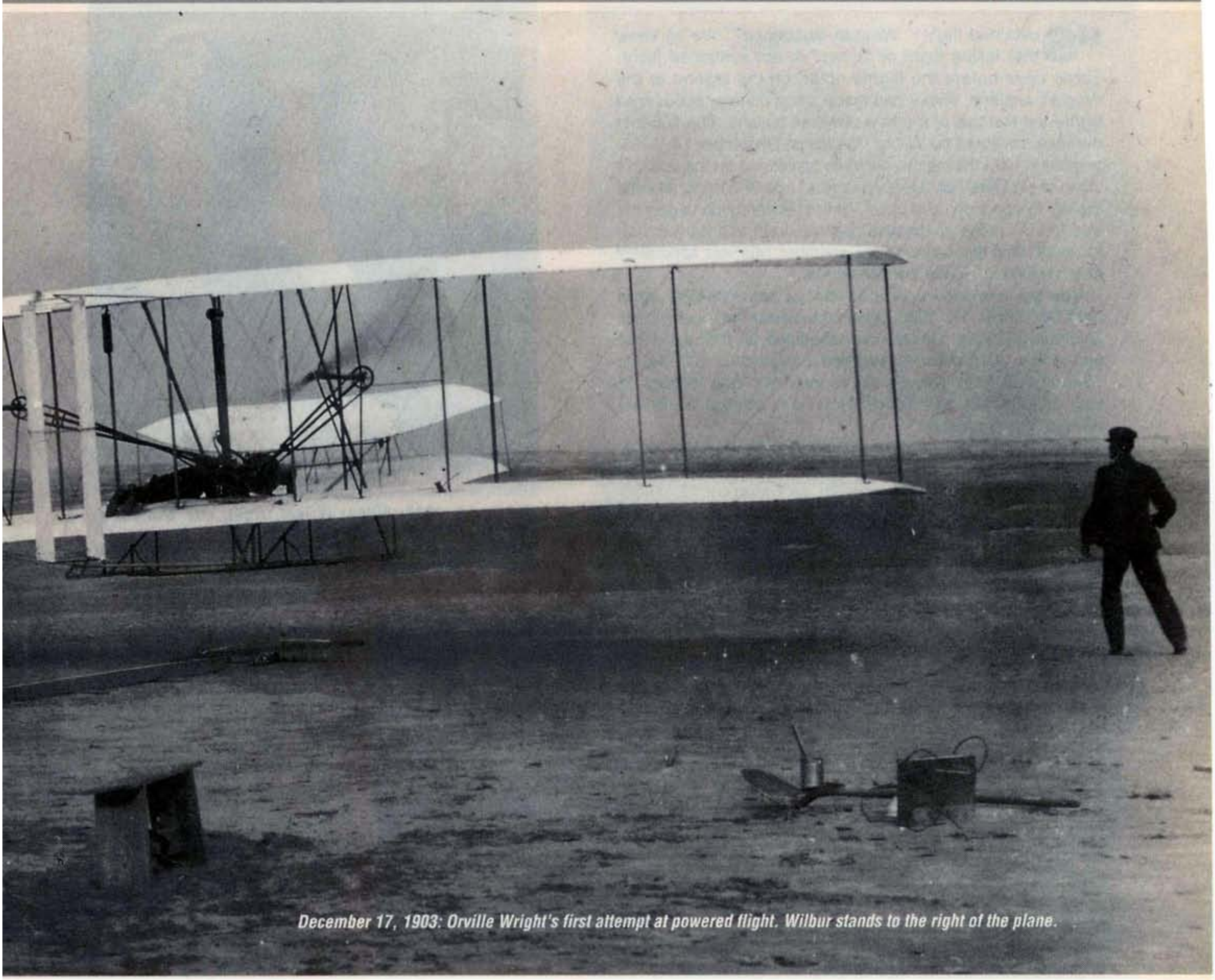
by MAJOR WILLIAM J. O'DWYER USAF Reserve (Retired)

Editor's note: which Wright brother—Orville or Wilbur—made the first powered, controlled and sustained flight? This article examines these questions in light of recently discovered documents not previously available to Wright historians or biographers. We think it will be fascinating reading for any with a deep interest in early aviation. The views expressed are those of the author and are not necessarily those of Model Airplane News.

This article is excerpted from a manuscript under preparation by the author for a new book, titled "Warped Wings." That book takes a close look at the implications of the newly discovered archives. The author assures us that whatever is quoted in this article has been portrayed in context, and we have done our best to vouchsafe that guarantee by reviewing copies of the original documents cited in the article. Available space does not allow for photographic reproduction of these documents. The author is willing to answer questions regarding the documents mentioned in this text. Interested parties can reach the author care of "Model Airplane News," 251 Danbury Rd., Wilton, CT 06897; fax (203) 762-9803.

The newly assembled 1903 Flyer sits next to the living quarters and hangar at the Wright brothers' camp. (Photo courtesy of Eastern National Park & Monument Association.)

PREVIOUSLY unpublished letters between Wilbur and Orville Wright, William J. Hammer (a primary confidant and business associate of theirs), and the Wrights' patent attorney, H. A. Toulmin, shed new light on the historically interesting question of when the first true, powered, controlled and



December 17, 1903: Orville Wright's first attempt at powered flight. Wilbur stands to the right of the plane.

sustained man-carrying flight took place.

When these letters are viewed with Hammer's "Chronology of Aviation" (a recently "rediscovered" document that was approved by the Wrights and that charts their listed successes of powered flights dating from December 17, 1903 through 1909), a slightly new picture of the earliest attempts at manned flight emerges. Did Orville, at the end of his life, succeed in taking credit for an epochal achievement that had earlier been attributed by all parties to Wilbur?

Although the answer to this question in no way lessens the tremendous debt aviation owes these courageous pioneers, it is nonetheless of historic interest. I will here reveal the documents that raise the question, and leave it to you, the reader, to decide.

THE HAMMER COLLECTION

The epicenter of this controversy is among a collection donated to Smithsonian Institution in 1962. It was an obscure collection IBM had acquired and preserved in storage for a museum IBM was planning. The documents were collectively known as the "Hammer Collection." William J. Hammer was a key figure in the Wright brothers' inner circle. Before meeting the Wrights in 1906, William Hammer was Thomas Edison's chief engineer and an internationally recognized scientific figure.

Hammer, an expert in patent protection, became a relied-on advisor to the Wright brothers and their lawyers. The Wrights hired Hammer as a consulting engineer and business advisor in 1910. A primary responsibility was to aid the Wrights in building a commercial aviation business.

Sometime in late 1985 to early 1986, all documents in the Hammer collection dealing with "Aeronautics" were removed from the main collection preserved at the Smithsonian American History Museum Manuscript Archive and sent over to Smithsonian National Air and Space Museum (NASM). To place the few documents relevant to this article in context, we need to look briefly at the working relationship between Wilbur and Orville.

WILBUR AND ORVILLE

The Wright brothers were mortals, not gods, with human imperfections as well as goals, and a lust for adventure and success. Wilbur was the elder brother and was noted for his mechanical genius. Orville, his sibling, often walked in Wilbur's shadow. Like all brothers, they may have argued and fought,

"Sustained flight?" What is "sustained?" We all know that falling flight or "a hop" is not sustained flight. Three days before the flights noted on the legend to the Wright's airplane, Wilbur had made a first attempt at powered flight—the first trial of the new powered biplane. The 105-foot distance traversed by Wilbur Wright, on December 14, 1903, originated from their wood-rail track positioned on the downhill slope of Kill Devil Hill. It leaped upward from the track, skewed slightly to one side, and upon landing, severely damaged the skid frame braces as the skid dug sideways into the sand on the slope. The flight attempt of December 14th was apparently only a short hop; it was not "sustained."

The brothers were unable to attempt powered flight again until December 17, 1903, when the headwinds were more favorable (27mph). Orville was scheduled for that day's first trial, which, in 12 seconds, reached a distance of 120 feet, or 15 more feet than Wilbur's trial of the 14th. Was Wilbur's "a hop" and Orville's "sustained?" How have aviation authorities defined "sustained flight"?

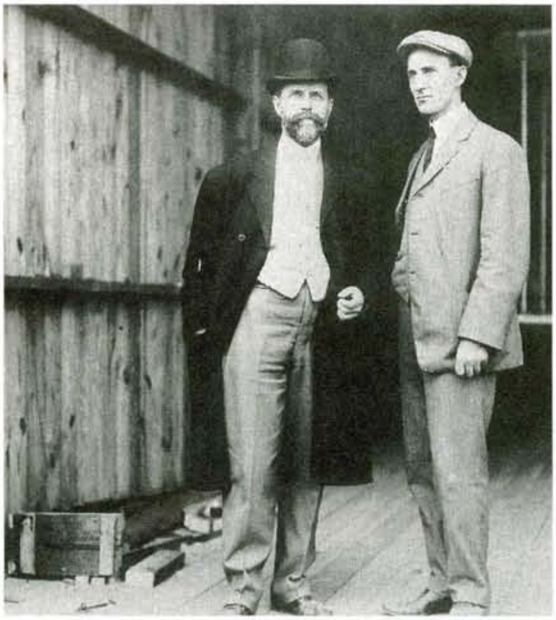
A definition offered by the Smithsonian National Air & Space Museum was repeated in a letter sent to this writer by (then) Director S. Paul Johnston, on February 17, 1969: *"...The criteria that we apply to any claim for flight in an airplane involve the ability for man and machine to rise from the ground, to proceed under power and control for a distance that proves sustained ability to support man and machine in the air, and to alight without wreckage at a location as high as that from which the start was made."* (History by Contract, page 210, by William O'Dwyer, copyright 1978, Fritz Major and Son, ISBN 3-92217500-7.)

What is Sustained Flight?

Headwind is a major factor that can reduce or expand ground distance. NASM's criteria overlooks "air distance," which is arguably the crucial "distance" factor. One could, theoretically, actually move backwards over the ground, or remain stationary over the ground, yet travel a "sustained flight" air distance while also demonstrating it was a controlled flight. Ground distance would only come into play if there is zero-wind. Since the first trial of December 17, 1903, was conducted in a 27 mph wind, the air distance for those 12-seconds was roughly 600 feet. Is 600 feet "sustained flight?"

Sir George Gardner, a former Director of the Royal Aircraft Establishment at Farnborough stated, in 1958: *"Clearly it is necessary to distinguish between an undoubted sustained powered, and controlled flight, and a 'powered leap.'...Nothing much less than a quarter of a mile would seem to remove all reasonable doubt that a flight was indeed sustained..."* In the fourth trial of December 17, 1903, Wilbur's air distance in his 59-second, 852-foot flight, given the 20-mile headwind, was approximately 1/2 mile.

The reader will have to make up his or her own mind whether Orville's initial effort on that fateful day constituted sustained, controlled, powered flight. As a side issue, the reader can also ponder the role of headwind in the initial attempts. If the four trials of December 17, 1903, demonstrated that the airframe rose under its own power, you must include in that definition the assistance of the headwind. The Wright brothers noted their inability to fly in winds of less than 20mph. Back in Dayton they built a catapult device to fling their next designs into flight. This helped them overcome ground drag—their true nemesis.



October 4, 1909: Wilbur Wright (right) and William J. Hammer. Hammer became the Wright brothers' trusted confidant and advisor, and he compiled the "Chronology of Aviation." (See text.)

Orville Wright in about 1908. (Photo courtesy of Eastern National Park & Monument Association.)

but they were inseparable when it came to business and making joint statements to the world through the media. Nearly all official correspondence to the outside world flowed through Wilbur. It was Wilbur who wrote to the Smithsonian and then to Octave Chanute (a noted glider experimenter, civil engineer and writer on developments in aviation in the 1890s). Chanute always addressed his letters to Wilbur.

Though the two brothers were in every sense a team, Wilbur was distinctly the dominant one. When they were apart, e.g., when Wilbur was in Europe, Wilbur never failed to leave instructions he expected Orville to follow. Chastisements surfaced if those instructions were not followed. When Wilbur was away, we can imagine Orville may have felt some degree of relief and independence as spokesperson. Yet all business affairs rested primarily upon Wilbur to organize.

Looking back, we have to sympathize with Orville when the media, time and again, sought out and quoted Wilbur. For his part, Wilbur became infuriated when misquoted, or when the writers who interviewed him went far beyond what Wilbur actually stated.

Because they wanted to protect their investment of time, labor and money, they waited until their patent had been secured before giving out details of their designs for controlling their aircraft while in flight. Only in 1908 did they release the now famed December 17, 1903 photo showing Orville during liftoff.

Although the Wright brothers had some form of informal agreement that they would share credit equally, one or the other was bound to take credit for the first manned powered flight. Today, Orville is generally credited with having taken the first powered flight. If we look at early representations by the Wrights of which flight was the defining "first flight," we see an interesting contrast.

THE JOINT STATEMENT

In an attempt to set the record straight with respect to their achievement, the Wrights submitted a joint statement, signed by both, to Augustus Post, secretary of the Aero Club of America, dated March 2, 1906. Post, wanting to copy the joint statement and distribute it to the Aero Club's large and prestigious membership, asked Wilbur if he could make their statement public. It was then printed on the Aero Club of America's letterhead stationary. The reprint was dated March 12, 1906—10 days after the original was jointly released by Wilbur and Orville.

Augustus Post made sure to note in parenthesis the typed note "(Signed)" in front of Wilbur and Orville's typed names. This document is attributed as a joint statement to this day by the NASM. The joint 1906 statement credited only Wilbur's 852-foot flight in 1903 as the first powered flight.

Another key statement that identifies the first flight was in a Wright-brothers-approved aviation chronology prepared by William Hammer. It is to be found among the papers in the Hammer collection at the Smithsonian.

THE CHRONOLOGY

Hammer produced the "1910 Chronology of Aviation," aided by Hudson Maxim, for the 1911 *World Almanac* edition. Hammer was the sole person ever to be "certified" by the Wright brothers to chronicle a list of their powered flight experiments while Wilbur Wright was alive. In October 1910, Hammer sent a handwritten letter to Wilbur Wright. His last paragraph states one of the purposes of his visit:

"Finally you will be interested to know that I am preparing an elaborate set of tables of airplane flights, etc., all over the world and I have worked for months on these and I expect to give particular prominence to a record of the work of Wilbur and Orville Wright and when I get to Dayton I wish to check up the data I have and want you both to help me make your record complete and accurate for it will be useful hereafter in litigation historically, etc....".

Hammer met with Wilbur and Orville and gathered data on their flight experiments from December 17, 1903, up through 1909. As his letters reflect, Hammer always submitted his writings and prepared lectures on the Wrights or their machines to the Wright brothers before publication. When he produced the 1910 "Chronology of Aviation," he first listed the flight records of Wilbur and then those of Orville, in that order. In a 1911, 20,000-copy reprint of the chronology, Hammer prefaced those identical entries with the following statement (italics, mine):

"Note—Prior to 1908 no one had made a flight of one hour; in 1908 there were 11; in 1909, 56, and since then they have been quite common.

"The following records, while they do not by any means include all of the flights made by the Wright Brothers, cover their most important flights, *and they have approved the records here shown.*

"It must also be borne in mind that the Wright Brothers had made about 2,000 soaring flights with their gliders before they essayed a flight in their power driven machine. (W.J.H.)"

Hammer's list of the first flights by the Wright brothers, on December 17, 1903, are shown here, with the flights in the order in which Hammer listed them.

"Wilbur Wright"

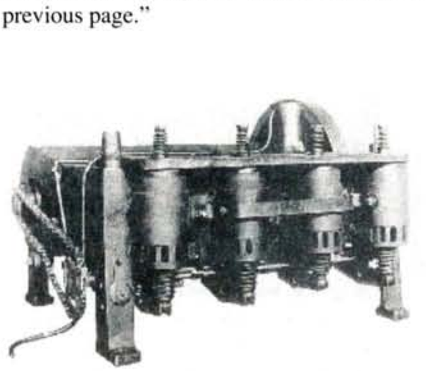
"December 17, 1903, at Kitty Hawk, NC, USA; time 12s. (this was second trial in 27-mile wind and did not demonstrate that they had power or control).

"December 17, 1903, Kitty Hawk, NC, USA; time 59s; flew 852 feet; this was the fourth trial and made in 20-mile wind (*this was the first actual flight by man in an aeroplane and demonstrated they had power and control).*"

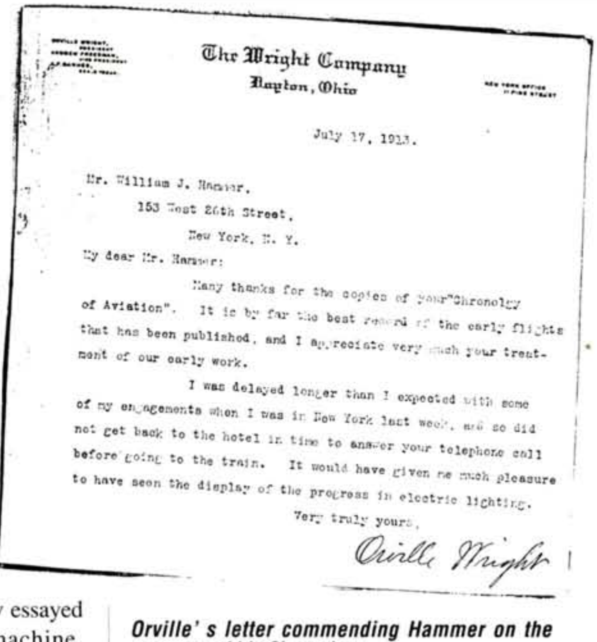
"Orville Wright"

"December 17, 1903, at Kitty Hawk, NC, USA; time 12s (this was the first attempt and was made in a 27-mile wind and did not demonstrate that they had power or control).

"December 17, 1903, Kitty Hawk, NC, USA; time 15s (this was the third attempt). Note fourth attempt by Wilbur Wright on previous page."



The Wright motor that was used in the first flights in 1903, after its reconstruction in 1928. (Courtesy of Eastern National Park & Monument Association.)



The Wright Company
Dayton, Ohio

July 17, 1913.

Mr. William J. Hammer,
153 West 26th Street,
New York, N. Y.

My dear Mr. Hammer:

Many thanks for the copies of your "Chronology of Aviation". It is by far the best record of the early flights that has been published, and I appreciate very much your treatment of our early work.

I was delayed longer than I expected with some of my engagements when I was in New York last week, and so did not get back to the hotel in time to answer your telephone call before going to the train. It would have given me much pleasure to have seen the display of the progress in electric lighting.

Very truly yours,

Orville Wright

Orville's letter commending Hammer on the accuracy of his Chronology.

The 1911 *World Almanac* containing William J. Hammer's "Chronology of Aviation" was entered as evidence in the U.S. Court of Appeals, Western District of New York, in the January 1911 landmark lawsuit filed by the Wrights against Glenn Curtiss. In that suit, the Wrights alleged patent infringements dealing with flight-control-system design. During cross-examination by the lawyer for Curtiss, Hammer was questioned if what he entered about the Wrights was accurate. Hammer replied: "They informed me by word of mouth during conversations regarding their flights...and they have seen the *World's Almanac* and have found no fault with this statement I have made."

Orville's endorsement of Hammer's chronology is shown in a 1913 letter that remains preserved in the Hammer Collection maintained by the manuscripts archive in the Smithsonian American History Museum. Orville's letter to William J. Hammer, written thirteen-and-a-half months after Wilbur died, reads:

"My dear Mr. Hammer:

"Many thanks for the copies of your 'Chronology of Aviation.' It is by far the best record of the early flights that has been published, and I appreciate very much your treatment of our early work.

"I was delayed longer than I expected with some of my engagements when I was in New York last week, and so did not get back to the hotel in time to answer your telephone call before going to the train. It would have given me much pleasure to have seen the display of the progress in electric lighting.

Very truly yours,,

[signed] *Orville Wright"*

Other contemporaneous reports of the

first powered flight also credit Wilbur. The April 7, 1906, issue of *Scientific American*, on page 291, in an article summarizing "The Wright Aeroplane and its Performances," states: *"The next step was to fit the machine with a suitable motor and propellers. This was done the latter part of 1903, and on December 17 the first flight was made with the motor-driven machine. This flight lasted only 59 seconds, but during it the aeroplane advanced a distance of 852 feet against a 20-mile-an-hour wind."*

That the world credits Orville today with the first flight is partly the result of the legend Orville mandated for the Wright Flyer exhibit at the Smithsonian. Orville died in 1948, and his will required that the Flyer have this legend. In conformance with the will, the legend was mandated by the November 1948 "Agreement" between the Smithsonian and the co-executors of Orville Wright's estate. The Smithsonian's Secretary Wetmore had to sign that agreement if he wished to acquire the 1903 Wright Flyer biplane from the heirs of the estate of Orville Wright. All of this occurred decades after Wilbur's death.

THE 1903 WRIGHT FLYER LEGEND

The legend quotes a poetic passage from an article titled, "The Wright Brother' Airplane," published in the September 1908 issue of *Century Magazine*. Following the quote on the exhibit legend appear the names of both brothers—implying the statement quoted was a joint statement issued by Wilbur and Orville Wright. It reads:

"The first flight lasted only 12 seconds, a flight very modest compared with that of birds, but it was nevertheless the first in the history of the world in which a machine carrying a man had raised itself by its own power into the air in free flight, had sailed forward on a level course without reduction of speed, and had finally landed without being wrecked. The second and third flights were a little longer, and the fourth lasted 59 seconds covering a distance of 852 feet over the ground against a 20-mile wind.

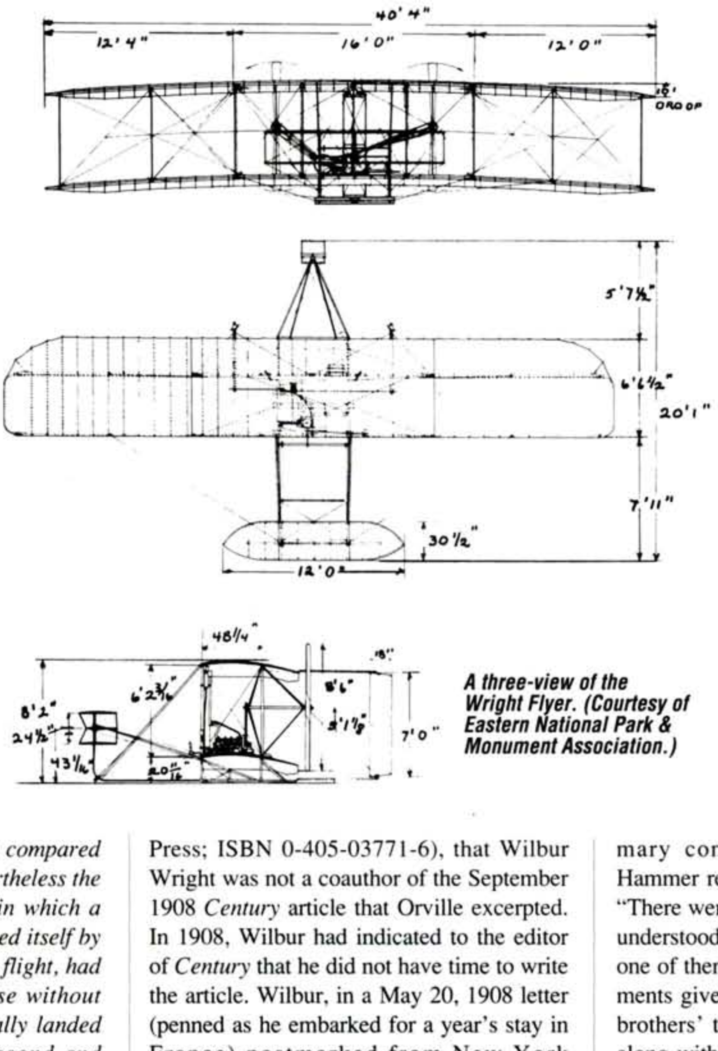
—Wilbur and Orville Wright."

Above the quoted passage, Orville's mandated legend contains the words: "The Original Wright Brothers Aeroplane," followed immediately by, "The World's First Power-Driven Heavier-than-Air Machine in Which Man Made Free, Controlled, and Sustained Flight…."

The legend suggests Orville was the first to pilot a powered aircraft in actual flight. To the best of my knowledge, there is no known writing in which Wilbur ever made a statement that Orville was "the first in the history of the world" to fly a powered machine in sustained and controlled flight.

One can infer from the "Papers of Wilbur and Orville Wright" (compiled by Marvin W. McFarland in 1953; copyright 1953 by McGraw-Hill; reprinted 1972 by ARNO Press; ISBN 0-405-03771-6), that Wilbur Wright was not a coauthor of the September 1908 *Century* article that Orville excerpted. In 1908, Wilbur had indicated to the editor of *Century* that he did not have time to write the article. Wilbur, in a May 20, 1908 letter (penned as he embarked for a year's stay in France) postmarked from New York City urged Orville to write the article, if he could find the time, and with his sister Katherine's help.

Wilbur, in his correspondence from France, requested that certain information—which was not included—go into the article.



A three-view of the Wright Flyer. (Courtesy of Eastern National Park & Monument Association.)

Orville probably signed both names to the article to give it more credibility (which they were fighting for) and as part of their informal agreement to present their findings to the world as a team.

CONCLUSION

The passage quoted in the label at Smithsonian, taken from the 1908 *Century* article, arguably contradicts the Wright brothers 1906 joint statement published by the Aero Club of America, Hammer's chronology, the report by *Scientific American*, and other contemporaneous writings not mentioned here.

Did Orville not really worry about the niceties of the definition of flight? Some have even suggested that Orville's first flight on the December 17 has been a focal point because the best photo of the day was of that flight. Or did Orville vacillate on who really flew first only when Hammer and Wilbur were no longer alive to contest what Orville demanded in the label's wording at Smithsonian?

AFTERTHOUGHTS

To my knowledge, the primary documents of correspondence and papers surfacing from the William J. Hammer Collection at the Smithsonian have never been explored by scholars of the Wrights or early aviation since their 1962 acquisition from IBM. We can read the correspondance that reflects Hammer's intense effort to accurately document what was achieved at Kitty Hawk in December, 1903, and all the stated conditions Wilbur set down when he retained Hammer's services as their primary confidant. We can read where Hammer recalls their patent attorney stated, "There were only two people who knew and understood the Wright Brothers—that I was one of them and he, the other." These documents give us a closer look into the Wright brothers' top-secret war room where they, along with Hammer and their attorney, laid their plans for their 1906 patent infringement lawsuit. The Hammer Collection, when placed side-by-side with earlier known documents yields a far clearer portrait of the Wrights, and will offer many more insights to future researchers. ■

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1993. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

BIG ALASKAN BEAVER

Ray Agen of Anchorage, AK, built this 96-inch-wingspan deHavilland Beaver from a Unionville kit and outfitted it with scratch-built Unionville floats. The model is powered by an O.S. .91 4-stroke engine, which sits in the cowl behind a dummy scale radial engine. The model has a 13x6, three-blade prop; flaps; landing lights; retractable water rudders; and a fully detailed and upholstered interior. Ray says that it's a really docile model with excellent flying capabilities.

ROUND-NOSE TEMPEST

Alex McGowan of Lancaster, CA, scratch-built this Hawker Tempest Mk III by modifying a set of Mk V plans from Bob Holman. The model is all balsa and plywood, and it has a silk and dope finish that's painted with Deft polyurethane paint and satin-finish clearcoat. The Tempest has a 60-inch wingspan and is powered by a K&B .65 glow engine. The model sits on B&D retracts.

WASHINGTON WATER BOMBER

Paul Harding of Spokane, WA, scratch-built this twin-engine, A-26 fire bomber, and he powers it with two Super Tigre .71s. The model is controlled with a Futaba radio, and it has homemade retracts; flaps; a detailed cockpit interior; working landing and navigation lights; and an operating bomb bay and water tank. The model weighs 17½ pounds and has a 92-inch wingspan.

WONDERFUL WACO

Dale Jensen of Boise, ID, built this great-looking Waco bipe from a PICA kit. It's his first scale project in quite a few years, and he was pleased to receive a second-place award in the Non-Military Stand-Off Scale category at the '92 Puyallup Expo in Puyallup, WA. Dale modified it a little and built the YMF-5 version. He powers the model with an Enya .80 4-stroker. The finish is Sig Koverall and K&B Super Poxy paint. The model has been painted to simulate a full-size ship based in Arizona.

PILOT PROJECTS

NAVY BEAR

Earl McMullen of Elkton, MD, built this great-looking Navy F8F Bearcat from Ziroli plans, and he powers the big Grumman cat with a Sachs-Dolmar 5.2 gas engine. Earl covered the model with light fiberglass cloth applied with Goldberg Jet CA, and then he painted the surface with Black Baron paint. The 36-pound fighter has lots of surface detail, including panel lines, hatches and rivets. Scale retracts, flaps, folding wings, a working tail hook and functional exhaust stacks set this cat apart from the rest.

SIMITAR CLIMB MAX

Beverly Sterka of Sarasota, FL, holds husband Bill's original-design Simitar Climb MAX flying wing, which is powered by a piped O.S. .46 engine. Weighing less than 5 pounds, the model has awesome flying characteristics. Bill used hot colors on the wing because he says, "Roll rate is some kind of incredible—not to mention ballistic vertical."

ULTRA PURPLE SPORT

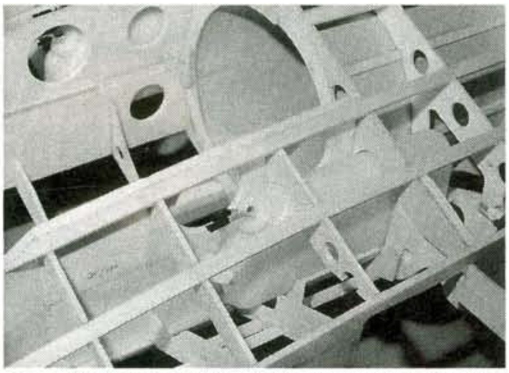
This big Ultra Sport 1000 is the work of Craig Collins of Perris, CA. Craig powers the model with a Super Tigre 2500 with a J'Tec muffler and a 16x10 prop. The UP1000 is covered with neon purple MonoKote and weighs 12½ pounds. B&D retracts clean up this giant sport model, which looks great and flies well.

¼-SCALE JEEP

Corwin Sylvester of Madison, WI, sent us this shot of his newest scratch-built model—a ¼-scale Art Chester Jeep. Corwin finished the old Cleveland-style racer with Super Coverite, and he powers it with a Super Tigre 3000. He says that it not only looks good, but it flies well, too.

PUP IN DISGUISE

This ⅓-scale R.A.F. S.E.5a was built by Bill White of Lexington, KY. Bill modified a Balsa USA Sopwith Pup kit; he used the wing plans but changed the wingtip outline, and he scratch-built the rest. The construction is of spruce, balsa and ply, and the covering is polyester fabric with two coats of dope and a lacquer finish. A really nice example of kit bashing, Bill!



Here, the left-side fuel tank (there are two) sits in its correct position next to the front opening of the duct tube. Note the generous use of stringers, which not only stiffen, but also strengthen the overall structure.

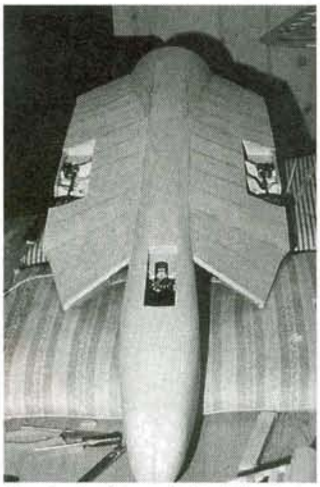
Over the years, work at Byron Originals, and in particular, work by Bob Violett, led to the development of more efficient fans. In 1987, new powerplants to drive these fans were becoming readily available, and I designed and built a model of the Northrop X-4 Bantam, which was .40-powered, weighed 8 pounds, had a 22-ounce wing loading and flew quite well. The Bantam was cute and somewhat interesting, though it lacked takeoff performance and, more important, it lacked excitement.

For my satisfaction, I needed a colorful design that had nostalgic value, with a lighter wing loading and a more powerful, efficient fan unit. After considering many possibilities, I discovered that there was, indeed, a "Ford" in my future when I found a book entitled, "Naval Fighters No. Thirteen: Douglas F4D Skyray," by Nick Williams and Steve Ginter*.

It took me a few weeks to select the aircraft my model would represent; then I determined the size by establishing a scale of 1/9.75. This meant my model would have a wingspan of 50¼ inches, a wing area of 1,337.5 square inches and a fuselage length of 67¾ inches. By limiting the model to 10 pounds, a non-fueled wing loading of 16 to 17 ounces per square foot can be obtained. Finally, for performance, the Skyray would be powered by an OPS* .80 coupled to a Byron* fan unit. Several months later, with the help of Douglas three-views and old Berkley .049-F4D plans, I completed my drawings.

SPECIFICATIONS

Model name: Douglas F4D Skyray
Type: 1/9.75 scale; ducted fan
Wingspan: 50¼ in.
Wing area: 1,337.5 sq. in.
Length: 67¾ in.
Weight empty: 9½ lb.
Wing loading: 16.37 oz. per sq. ft.
Fuel capacity: 24 oz.
Engine used: OPS .80
Fan unit used: Byron
Wing construction: wood
Fuselage construction: wood



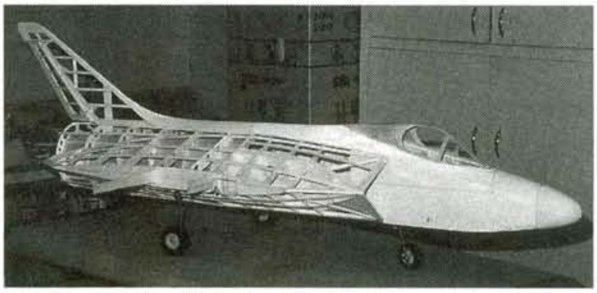
Here's the lower half of the fuselage with the nose attached and the lower sheeting installed; ¼-inch-thick balsa is used to form the lower part of the fuselage. The gear doors haven't yet been installed.

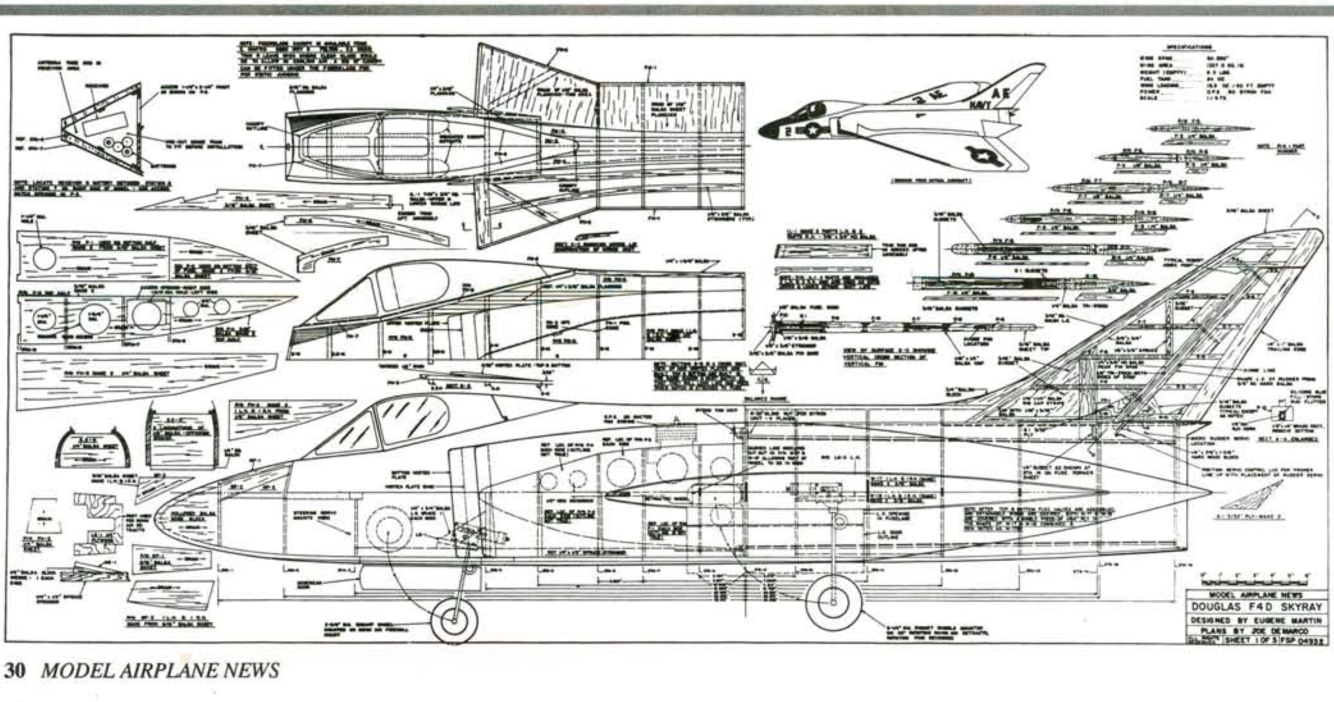
The construction of my F4D Skyray was very time-consuming, and it presented me with many challenges. If a "Ford" is in *your* future, take some time to study the plans. Determine the type of wing and landing gear you wish to employ, and construct your Skyray in a well-thought-out manner. The result will be a high-performance model that will generate an aura of excitement everywhere you take it.

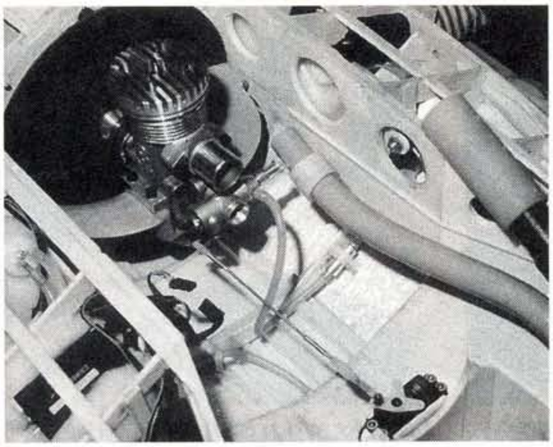
Except where indicated, all the materials used to construct this model can be bought at any good hobby shop or ordered from Tower Hobbies*.

Editor's note: The following information is a condensed and simplified explanation of the Skyray's construction. The Skyray is

The almost completed fuselage. The upper and lower halves have been glued around the duct tube and to each other, and the forward fuselage section has been attached. The canopy is made of fiberglass.







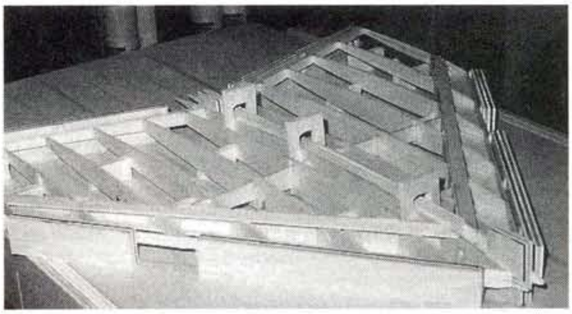
An OPS .80 coupled to a Byron fan unit powers the Skyray. Notice that the lower floor has not yet been installed. All the linkages, wires and air lines must be installed before the floor is completed.

built of balsa and plywood and is very conventional in design. Complete and detailed building instructions accompany the plans.

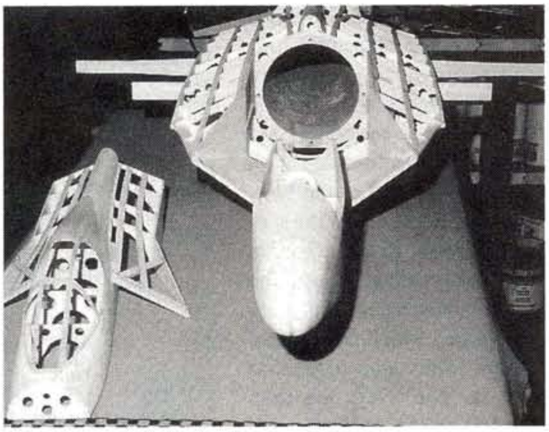
CONSTRUCTION NOTES

A 30x60-inch, flat building board is required, and a hollow-core door is an excellent choice. Both wings are built at the same time on one end of it, and the fuselage is built and assembled on the other end. It is important to construct the duct tube first because the tube will be used to size the fuselage formers before they are assembled. A duct-tube assembly jig is shown on the plans; its use ensures a straight tube and greatly simplifies construction. Because the fuselage is built up around the tube (while the tube is still on the jig), a straight and true model is practically assured.

The positions of the related fuselage formers are drawn on the outside of the duct tube, and the stringers and the formers are then added to the assembly, thus forming the basic fuselage structure. The formers and other parts that make up the bottom half of the fuselage are first built and then fitted (but not glued) onto the duct tube. To ensure proper placement of all the parts before gluing them together, attach scrap balsa rigging to the formers and building board (with the bottom of the fuselage facing upward).



The wings and the fuselage are built over the plans and assembled using wooden jigging to ensure that all the parts stay straight.

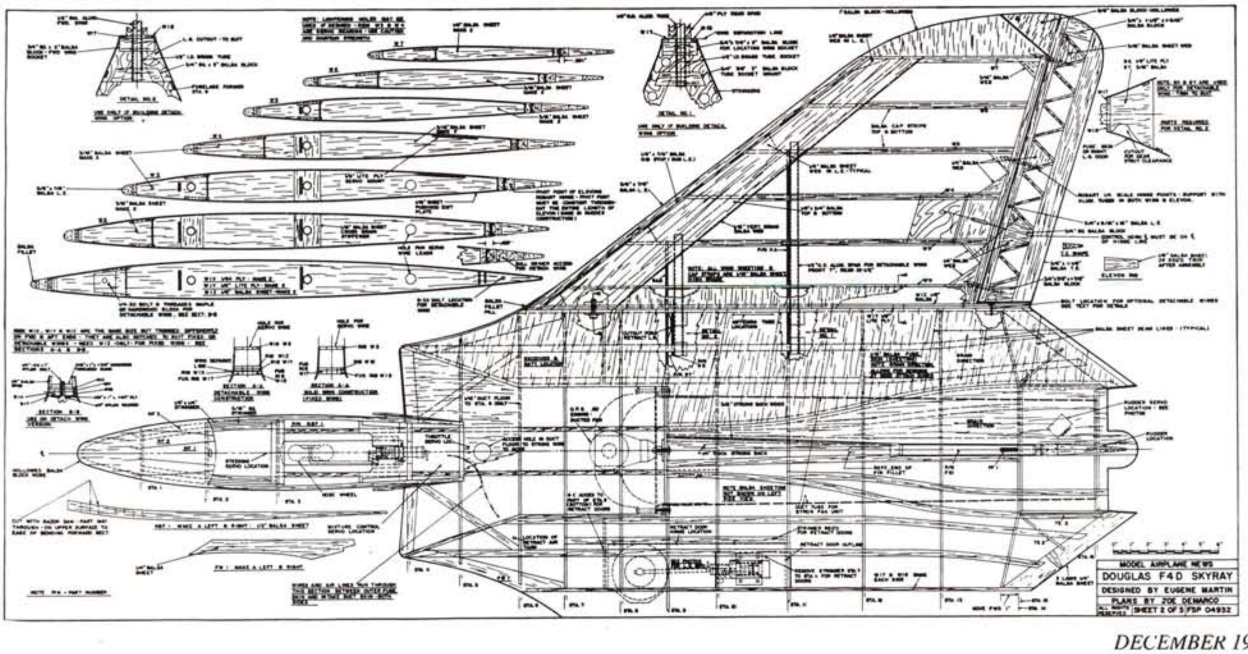


The fuselage is built in halves—upper and lower—that are joined to each other and to the duct tube. Also shown here is the main fuselage hatch, which is built in place on the fuselage.

After everything has been built, remove the fuselage bottom half from the building jig by cutting away the scrap balsa rigging. After gluing the duct tube (still on its jig) into the fuselage formers, place the tube stringers around the duct tube and install the inlet inner skin. Once all the parts and hardware have been installed, the upper fuselage formers are glued to the duct tube and to the corresponding lower formers.

At this point, the jig is removed from the duct tube and the Byron fan shroud is fitted into the forward end of the tube. After the shroud has been properly aligned, it is used as a drill jig to position its mounting holes; 8-32 blind nuts are inserted into the holes to hold the unit securely in place.

After the remaining formers and parts have been glued into place, all the parts for the vertical fin and the rudder are built using balsa rigging, and they are made ready for installation on the fuselage. Once the fin and rudder have been installed, the fuselage is 95 percent completed. Then, while in place,



FSP12931–PRICE $25–
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FLIGHT PERFORMANCE

• Takeoff and landing

Owing to its wide landing-gear stance, the F4D has excellent ground-handling characteristics. Because of its light wing loading, however, it has to be held on the runway by maintaining neutral elevator until flight speed is attained—usually between 100 and 150 feet. Then, with the application of up-elevator, it will rotate and reach for the sky.

The model is also very stable in its landing approach; but, because of its lightness, it will slow down very quickly, and some power will be required to ensure good penetration. As the model approaches the landing strip, applying slight up-elevator will lift the nose. If it is too far out, you can extend its descent by adding a little more power. The F4D handles well in a nose-up attitude and on its approach to the runway, it will look like a duck landing on water. When the mains touch, cut the power and the nose will settle; then, its excellent ground handling will come into play.

• High-speed performance

At top speed, the model will fly at about 120mph. It penetrates well, and it responds quickly and accurately to the controls. Crosswinds or gusts do not bother it very much; it will not balloon when turned into the wind.

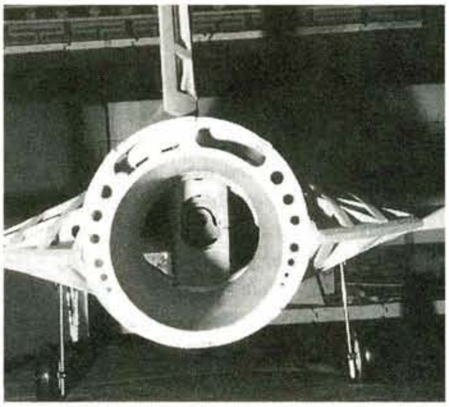
• Low-speed performance

As with most ducted-fan models, the F4D is not known for its low-speed performance, but, again, because of its lightness, it is easily controlled and will even fly well inverted, at third- to half-throttle. Its pitch control is very quick and positive, even at slow flight speeds, so you need to go easy on elevator commands during final approach.

• Aerobatics

It is quick! If you blink your eyes, you can miss an entire axial roll. Inverted, it takes only a slight amount of down-elevator to maintain level flight. Under full power, loops, knife-edges, outside loops, split-S's, Cuban-8s, and eight-point rolls can all be precisely completed. For a ducted-fan model, its vertical performance is exceptional.

At the California 1992 North-South Meet in Clovis, CA, my F4D placed second in Team Scale. John Lockwood, my test-pilot and friend, flew the model, and he received the highest flight score (91.7) of the entire meet.

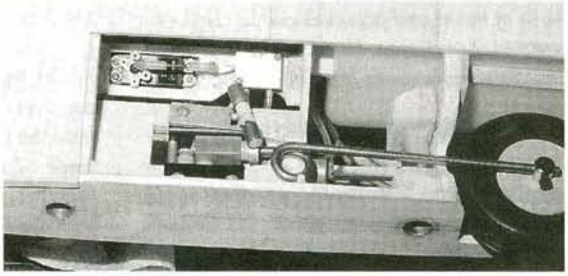


This rear view shows the duct tube surrounded by the fuselage formers. The plans show an assembly jig fixture that's used when forming the duct tube. The fixture stays in the tube while the model takes shape.

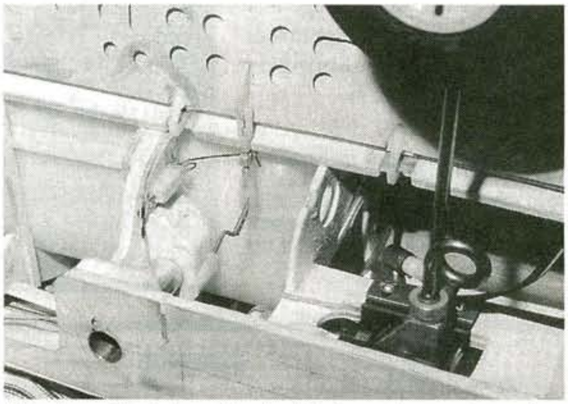
The rudder servo is installed between the top of the duct tube and the upper fuselage sheeting. The linkage is short and minimizes control slop.

the fuselage hatch is built (with wax paper underneath it, so it doesn't get glued to the main fuselage framework). After everything has been shaped and aligned, the wings can be built.

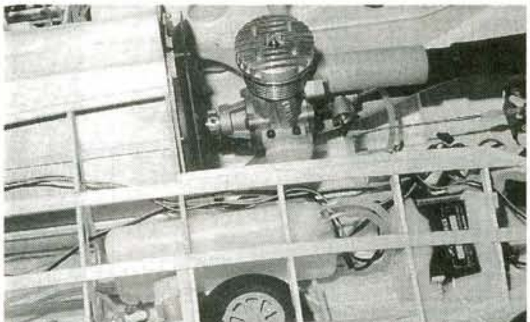
On the plans, there are details for both fixed and removable wings. Each version is built using alignment jigs similar to those used when building the fuselage. For the fixed version, the wings are attached to the fuselage with spars that are part of the fuselage structure, and they're glued into place. For a removable-wing setup, the common fuselage/wing spars are replaced with brass and aluminum tubes and alignment sockets. The wings are then attached to the fuselage with nylon screws and machine screws. Retracts are shown on the plans; I used Rom-Air* units and operable gear doors.



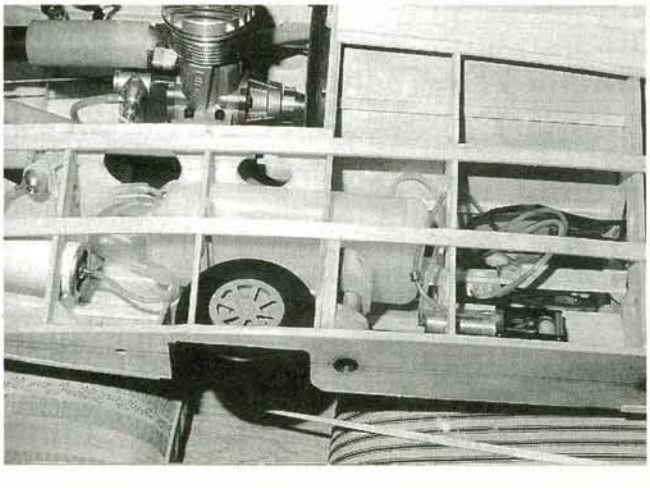
The right main landing gear in the retracted position. Notice the plug-in wing-socket tube, which is just under the retracted landing gear. The retract servo and sequence valve are above and to the left.



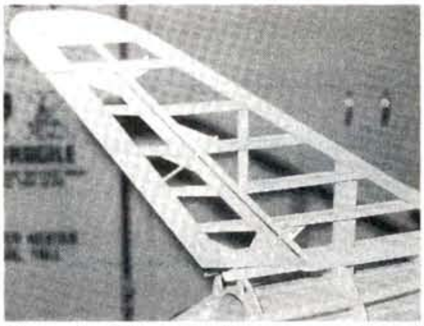
This shows the linkages involved in the main gear door setup. Also visible are the gear-mount plywood plate and the plug-in wing-socket-tube support blocks.



The receiver and battery have been installed in front of the right-side fuel tank, and the antenna runs aft through a thin plastic tube. Notice the servo-lead wires; it's easier to use wire than pushrods—lighter, too!



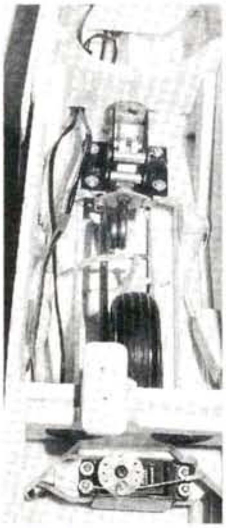
The installed left main landing gear next to the port fuel tank. Notice the position of the air storage tank (forward of the gear). Do all t his work before you glue any fuselage sheeting into place.



The vertical fin and rudder are easy to build and attach to the fuselage. The tail and the wings have cap-stripped ribs and are covered with film.

FINAL ASSEMBLY

With the wings completed, the bottom of the fuselage is sheeted (starting from the tail cone and moving forward), using ¼-inch, sheet-balsa filler to cover and shape the fuselage center bottom. When this has been done, install the radio; the pneumatic, retractable landing-gear system, if used; and all the mechanical systems needed to complete your Skyray. Then sheet the top of the fuselage and the hatch. Add the fiberglass canopy (available from Eugene Martin*) and the inlet baffle plates and the model is ready for covering.



The nose-gear unit is mounted on a plywood plate and supports. The steering servo is seen aft of the wheel.

FINISHING

As can be seen in the photos, the wings and tail are of open-bay construction with cap-stripped ribs. This saves a lot of weight and simplifies construction. It was not my intention to add a lot of surface detail, so a film covering is completely acceptable.

I selected my color scheme from the book "Naval Fighters No. Thirteen." I covered my model with Goldberg's* Ultracote and Coverite's* Black Baron Presto Covering. My color scheme uses 12 different colors. Only the varying shades of flat black, the medium-gray fin tip and the zinc-chromate primer surfaces are painted.

After covering the Skyray, install and secure the elevons, the rudder and any other parts needed to complete the model.

(Continued on page 98)

F4D-1 SKYRAY

Development at Douglas Aircraft Co.

When the graceful, compact features of the Skyray were first unveiled in February 1951, many observers wondered why a company like Douglas Aircraft would produce such a radical interceptor. The answer lies in the influence of Jack Northrop, chief engineer of the Douglas plant (known as the "Northrop Division" of Douglas Aircraft) when it was in El Segundo, CA.

After Northrop's departure in 1938, and throughout the war years, the studies on tailless aircraft at Douglas continued. In 1945, with the captured studies of Germany's Alexander Luppisch, designer of the ME-163, an approach to the problem of poor range for jet aircraft seemed at hand. The solution appeared to be a flying wing of very low aspect ratio, using a boundary-layer control to reduce drag. A design was established during the late forties, and by 1950, the XF4D-1 had emerged as one of the unique aircraft of its time.

Fortunately, the early 1950s seemed to be a time when it was possible to build any type of aircraft, from the weird to the wonderful. Some of these aircraft benefited from the innovative designing of the period; at the same time, these aircraft often had unforgiving and dangerous flying characteristics. The Skyray fell into this category because many of its design parameters fell into the domain of the unknown. This was a common occurrence at this time, because manufacturers like Douglas Aircraft were pushing technology beyond the established limits.

In any event, the first Skyray was ready for flight on the morning of January 21, 1951. Larry Peyton sat in the cockpit of that glossy blue fighter at Edwards AFB and prepared himself for what was to be the most terrifying flight of his life. During the takeoff, as he eased back on the stick, he found, to his dismay, that as the air speed increased, so did the pitch angle. He found himself in a rapidly deteriorating situation because the rise continued even after he pushed the stick fully forward against the panel.

PHOTO COURTESY, BOB BANKA– SCALE MODEL RESEARCH

Trying to correct the problem, he gave the trimmers a quick downburst. This caused the nose to pitch down rapidly. To counter this, Peyton pulled back on the stick. This had no effect, so he brought the trimmers to their original takeoff position. Then the aircraft suddenly flared and settled back onto the ground. To those watching Peyton fight the bucking Skyray, it appeared that the airplane was about to be lost.

Undaunted, Peyton went back to the starting line and tried again. On the second liftoff, he used the throttle to control the rate of climb. Flying level at 10,000 feet, Peyton found the Skyray surprisingly solid laterally, but very sensitive to the stick longitudinally. The control system was oversensitive. It didn't have any proper null points, and there was no relation between how far you moved the stick to where you got a reaction. The roll rate was awesome: if you could handle it, you could slam the stick over and do 360 degrees per second. A strange phenomenon occurred as the roll stopped momentarily at the wing's level position and then continued without any change in stick pressure or position.

Satisfied that he had done all he could in the first flight, Peyton leveled up for a straight-in, power-on landing approach. He carefully flared and reduced the power. The aircraft began to settle too rapidly, and full-aft stick wouldn't correct the situation. In desperation, Peyton applied up-trimmers, and when the aircraft ballooned, he shoved the stick forward again. Luckily, during one of these oscillations, the Skyray touched down on its mains and settled safely on the ground.

Nine months later, another test pilot, Bob Rahn, rated the Skyray as the fighter pilot's dream. Once you got used to it, the Skyray had:

- maneuverability at altitude;
- extremely high rate of climb;
- short takeoff and landing;
- high service ceiling;
- excellent low-speed handling;
- high-speed level flight.

In service, pilots referred to the Skyray as a "bat out of hell" because of its tremendous rate of climb. This feature took the Skyray into service at the Air Defense Command in both San Diego, CA, and Key West, FL.

The F4D, commonly called the "Ford," had flying qualities and controls that were so unusual that the aircraft was used at the Test Pilot School until 1969 so that students would know how an unstable aircraft flies. Yes, it can truly be said that the Skyray was one of those weird and wonderful aircraft that enabled the U.S. Navy to maintain its worldwide presence and to develop the aircraft of today.

A SPORT SCALE SKY DANCER

Cermark ARF Sukhoi .60

PHOTOS BY GERRY YARRISH

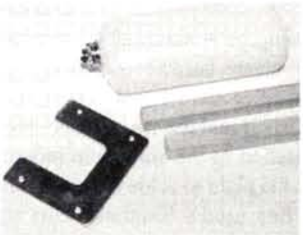
by GERRY YARRISH

AT THE Cermark* booth at the 1992 Chicago Hobby Trade show, I saw a very nice, all-wood ARF Sukhoi. After a close examination, it was hard to believe that it was an ARF because it was so well constructed. The Sukhoi looks like (but doesn't require the same time investment as) a traditional built-up model. It even comes covered with Ultracote*. Although the plane is 85 percent built when you pull it out of the box, no one at the flying field would ever think it's an ARF.

THE KIT

The well-packed kit contained no broken parts, and none was missing. All the major components, i.e., the fuselage, the wing halves, the horizontal stab elevators, the rudder and the vertical fin, were completely built, sanded and covered, and all the surfaces were hinged. The covering job was very good, plus the wingtips and the control-surface cutouts were neatly done.

The kit includes a fiberglass cowl and belly pan; a clear plastic canopy; aluminum landing gear with wheels and axles; bolts; pushrods; clevises; control horns; and a tail-wheel assembly. The very slim specs/assembly booklet was the only thing that needed improvement. Cermark assumes that you're an experienced modeler, so there's a minimum of information in the booklet. The plans—which are actually only scale three-view drawings of the model—don't include a measured CG location. Recommended control-surface throws are included, however, and I found that they were correct. Considering the amount of prefabrication in the kit, this omission definitely isn't a good reason to avoid buying it. Any experienced modeler can easily figure out the missing information.

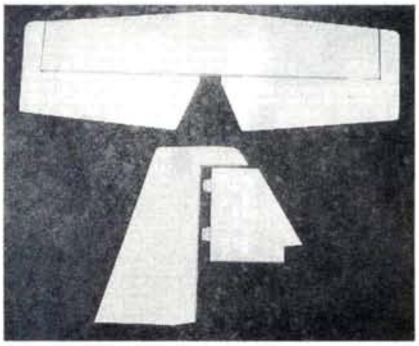


The model has hardwood engine rails and an aluminum engine-mounting plate that makes engine installation easy. The 14-ounce fuel tank fits into a compartment next to the engine rails. I replaced the screw on the tank cap with a conventional stopper.

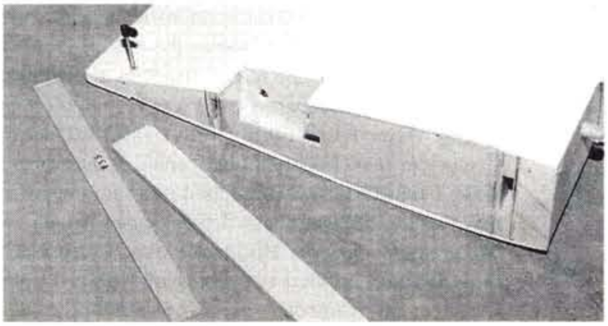
ASSEMBLY

I started by gluing the wing halves together using Sig* 30-minute epoxy. The two plywood dihedral supports that slide into slots in the wing roots fit the pockets precisely and all but guarantee a perfectly aligned wing. While the glue dried, I taped the halves together, and since I had some epoxy already mixed, I checked the aileron torque tube for proper movement and epoxied the aileron hinges into place. To prevent the glue from getting on the hinge pins, I applied a few drops of silicone mold release agent to them.

When the wing had dried, I installed the tail surfaces on the fuselage using thick CA and kicker. I only had to remove the covering from the area where the fuselage and the control surface meet. The horizontal and vertical stabs fit on the fuselage very well. The slots didn't require any trimming, and the parts were correctly aligned after they had been glued into place.



Above: the tail feathers come completely shaped and covered with Oracover, and the hinges come installed, but not glued into place. Both surfaces are scale in outline and have counter-balanced tabs.



Right: the wing is made of balsa and plywood and is completely planked. I only had to glue the halves together and glue the aileron hinges into place. Even the aileron torque tube control rod is in place.

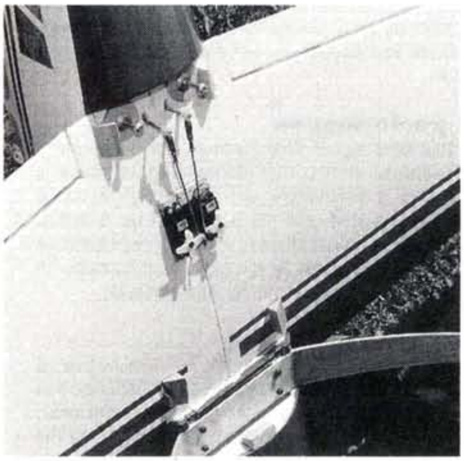
SPECIFICATIONS

Type: Sport scale aerobatic
Wingspan: 57 in.
Length: 50 in. (including spinner)
Weight: 8.25 lb.
Wing area: 627 sq. in.
Wing loading: 30.31 oz./sq. ft.
No. of channels req'd: 4 (throttle, aileron, elevator and rudder)
Airfoil: symmetrical
Wing construction: built-up wood, fully planked
Fuselage construction: built-up wood with built-up and sheeted tail surfaces
Washout built in?: no
Engine used: Webra .61 2-stroke with Slimline Pitts-style muffler
Sug. engine range: .60 to .90 2-stroke, .90 to 1.20 4-stroke
Prop used: 12x6
List price: $290 (ready to cover); $345 (covered)

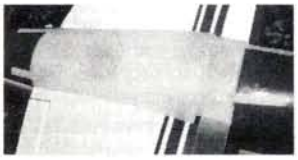
Features: the kit comes with everything needed to complete the model: fiberglass cowl and belly pan; aluminum landing gear, wheel and axle bolts; fuel tank and plumbing; hardwood engine rails; aluminum engine-mounting plate; clear plastic canopy; threaded steel control horns, pushrods and clevises; and aluminum louver plate. The kit can be ordered covered or ready to cover. Decals and a brief instruction manual are also included.

Hits
- Highly prefabricated wooden construction
- Excellent attention to construction details (glue joints, proper use of materials, etc.)
- Good flight characteristics
- Excellent value

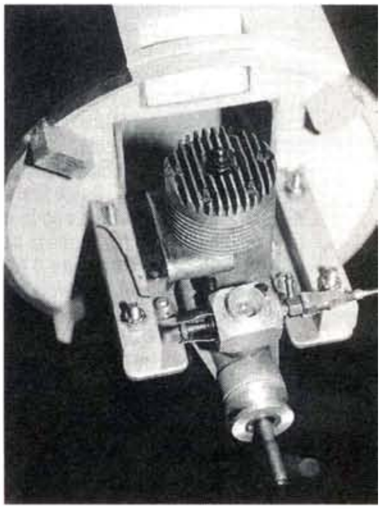
Misses
- Minimal number of instructions
- No construction plans (but a scale three-view drawing of the model is included)
- No CG location information



Left: to enhance flight control, I installed two JR-3321 high-speed servos and combined them for aileron control so that I could mix in some flap control. A standard JR-517 servo would be adequate.



Above: the wing's center section is covered with this fiberglass belly pan. Hardwood blocks and screws keep it in place.



Right: a Webra .61 2-stroke engine is used to power the SU-26. It has good power and fits the mounting plate perfectly.

FLIGHT PERFORMANCE

The Cermark Sukhoi was flown with a Webra .61 2-stroke engine and a 12x6 prop. The first flight was less than rewarding because the CG was placed about 1½ inches too far back. The plane took off with more than enough air speed, but when up-elevator was applied, the model entered the dreaded "over-control and tip-stall" mode. The model hit the ground hard, and this caused the landing-gear plate to break out and the engine cowl to crack. A week later, we were back at the field with the correct CG, and we found the model to be a good—though slightly heavy—flier. The correct CG position is 2¾ inches back from the leading edge, measured at the wingtip. This works out as 4 inches from the leading edge measured 5½ inches out from the center rib.

• Takeoff and landing

The model taxis well because of its 20-inch wheel stance, and on takeoff, only a little right rudder is required to keep the model tracking straight. Some up-elevator was used to keep the tail wheel planted for good steering. The model should be flown off at a low climb angle to allow plenty of air speed to build before you point the nose up. The .61 engine and 12x6 prop provide plenty of thrust, and the model accelerates well. On landing, speed must be kept up and the nose must be kept level. The model has no snap-stall tendencies, but because of its wing loading (30.31 ounces per square foot), the wing requires higher air speeds to fly well. When you're accustomed to the feel of the model, you'll find that you can really grease this one in. A wheel landing is preferred. The only drawback is that you need a lot of runway to slow down and stop. On my relatively small flying field, we ran out of runway a few times after touchdown and ended up in the rough.

• High-speed performance

The model flies fast, and it's here that the control feels most comfortable. Aileron control is good and not overly sensitive, and the elevator is very effective. No trim change is required at top speed. Rudder gives very quick yaw corrections and has a lot of clout. In a word, it's predictable.

• Low-speed performance

Like many models that have higher wing loadings, the Sukhoi, with its tapered wing, becomes increasingly demanding as speed is reduced. Aileron control is diminished, but not enough to cause worry. More elevator is required, and the nose must be raised to maintain level flight. Rudder is most affected at slow speeds because most of its surface becomes blocked by the big, round fuselage. In the landing pattern, keep the nose level and speeds moderate.

• Aerobatics

The model is very aerobatic, but with the .61 2-stroke engine, it wasn't overpowered, and vertical performance was limited. For true full-size Sukhoi performance, a 4-stroke 120 would supply the needed power, but the added weight of the big engine might affect the model's already limited slow-speed handling; what you'd gain in performance would be paid for in increased landing speeds. A good .90 4-stroke with a bigger prop would be a better engine and would still improve vertical performance. Loops track easily, and there isn't much speed build-up on the downhill side. Rolls are very axial. The roll rate is fast but comfortable, and the model snaps very well. It has to be flown fast to maximize its aerobatic performance because, at slower speeds, it loses inertia quickly. At fast speeds, elevator control is solid, but at reduced speeds, the model *did* snap out at the bottom of a tight loop. Quick four-point rolls are impressive with little or no loss of altitude. Long four-pointers make the model slowly lose height. Knife-edge flight is also good, but the rudder couldn't pull off a climbing knife-edge. I found it best to enter the maneuver in a shallow climb and then roll into it with the nose already pointing slightly upward. I think that a more powerful servo or rudder would help.

The model is very honest. When I flew it, I found its stability to be neutral (point it and it goes there). For the experienced modeler, it offers no surprises, but it isn't a model for novices.

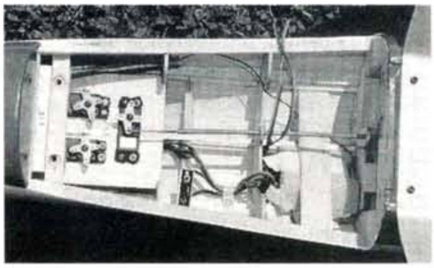
I installed the hinge for the tail feathers using epoxy. Just before I glued the rudder into place, I screwed the tail-wheel assembly onto the fuselage and embedded the top of the axle wire into the rudder's lower leading edge. I added an additional hinge—left over from the Cermark Ultima Biplane kit—about an inch above the axle wire.

I installed the main landing gear and the wheels, and the fuselage was complete. Instead of using the nuts and bolts that were supplied with the kit, I used 6-32 cap screws and large T-nuts. To give the gear a little "give" to help absorb landing loads, I installed a small O-ring on each mounting screw between the landing gear and its plywood mounting plate. The gear comes drilled and ready to install.

FIREWALL FORWARD

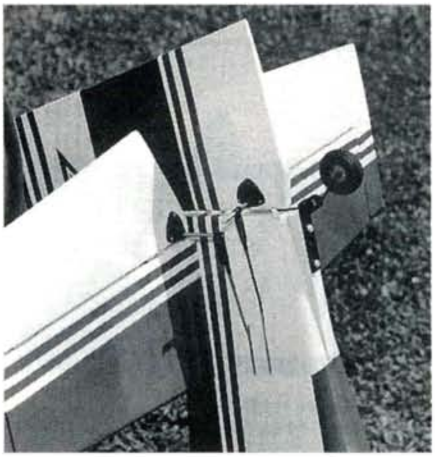
The engine is mounted on an aluminum plate, which is bolted to two ⅝-inch square hardwood rails that run from the firewall to the former, just forward of the wing. Using 30-minute epoxy, I glued the rails, the fuel-tank shelf and the two side doublers. The Webra* .61 2-stroke engine that I installed fit the aluminum mounting plate perfectly, and I didn't have to trim the plate to achieve zero degrees of side or down engine offset.

I first used a Slimline* Pitts-style muffler with an extension added to clear the lower mounting rail. It really enhanced the model's scale appearance, but it didn't meet our field's 93dB noise-level limit. To satisfy this requirement, I had to switch to a baffled muffler that had a larger volume. Ultimately, an old Davis Diesel* heli muffler was used, and I simply cut an opening in the cowl's bottom rear edge so that the model would stay clean of exhaust guck!



The fuselage is roomy, any brand of radio will fit. The servo tray comes already cut out and ready to glue into place.

I covered the square opening in the firewall just behind the engine with 1⁄16-inch-thick plywood. I then cut a 1-inch-diameter hole in the plywood for the neck of the fuel tank. I glued the tank to the plywood using PFM* adhesive, and since the fuel tubes stick out into the engine compartment, it's very easy to hook them up to the engine.



Instead of the usual plastic control horns, the kit supplies these high-quality threaded rod horns, which afford very precise adjustments.

I sealed the entire firewall and the mounting rails using polyester resin. Four small plywood tabs are glued to the firewall to accept the cowl-mounting screws. I didn't like this arrangement because vibration could cause the tabs to break off, so I replaced them with ¼x½x¾-inch-long hardwood blocks that I drilled and tapped to accept the mounting screws.

Although the fiberglass cowl was very light, it had many pinholes in its weave. After I had lightly primed the surface with Coverite's* 21st Century primer, I applied many coats of spot filler to fill all the pinholes. Next, I sanded the cowl, applied two more coats of primer and sanded it again using 220-grit paper. I then wiped it with a tack cloth and applied two coats of Coverite Hi-Gloss white. When that was dry, I masked off the cowl and applied two coats of Hobby Lobby's* new Superfinish Oracover and Ultracote's matching dark blue paint.

WING MOUNTING

The leading edge of the wing's center section is notched and contoured to match the fuselage's round shape. I glued the two wing-alignment dowels into the wing and then slipped the wing into the wing-saddle cutout. The wing didn't fit tightly against the saddle's edge along its full length. To fill in the spaces, I applied a small amount of white bathtub sealant to the saddle. I then marked and drilled the holes for the wing hold-down bolts and reinforced the wing's trailing edge around these holes using two 1-inch-diameter, ⅛-inch-thick plywood disks.

After I had bolted the wing into place, I installed the fiberglass belly pan with its mounting blocks and screws. It, too, had a fair number of pinholes. It was finished and painted in the same fashion as the engine cowl.

RADIO INSTALLATION

A plywood servo tray comes with the kit and fits between the two aft fuselage formers just above the wing's trailing edge. I used a JR* X-347 radio and a 600mAh battery pack. I first installed the throttle, rudder and elevator servos to determine the length of the pushrods. I used a JR-505 servo for the throttle and two JR-517s for elevator and rudder. I attached Sullivan* fiberglass pushrods to the servos using Z-bends. The elevator halves aren't connected with a wire joiner, so a Y-shaped pushrod with two clevises at the end is required. The threaded control horns for the elevators and the rudder are very nice, and you can use them to make very fine adjustments. I use a flexible pushrod for the throttle linkage and two JR-3321 servos for aileron control. Having the ailerons on separate channels allows me to include some flap mixing, which will ease landing speeds and overall response. I mounted the receiver and the battery pack forward in the fuselage, and to prevent them from shifting around, I glued thin balsa strips over them. With everything in place, the CG came out too far back, and I had to use nose weight to correct it.

FINISHING TOUCHES

I installed a William Bros.* pilot in the cockpit and added decals to the instrument panel. I glued the canopy in place using PFM adhesive.

The model came covered in white, and I decided to trim it with dark blue. Instead of simply ironing the blue Oracover directly over the white finish, I carefully removed all the white covering from the areas to be trimmed (about 40 percent of the entire finish, but the extra effort was well worth it). I

(Continued on page 98)

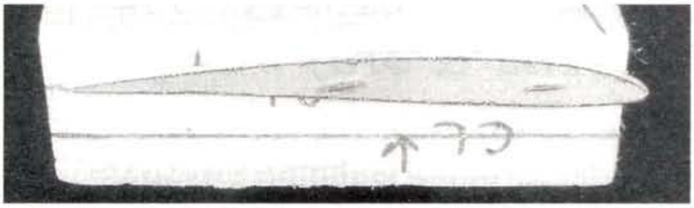
HOW TO

Make Easy Elliptical Foam Wingtips

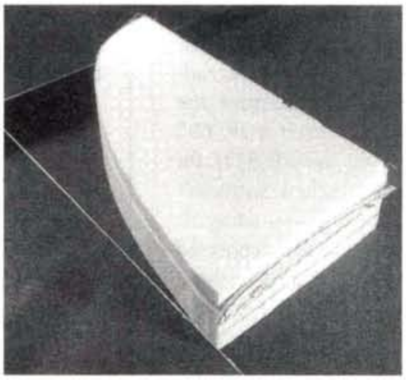
by GEORGE VOSS

A simple foam-cutting technique

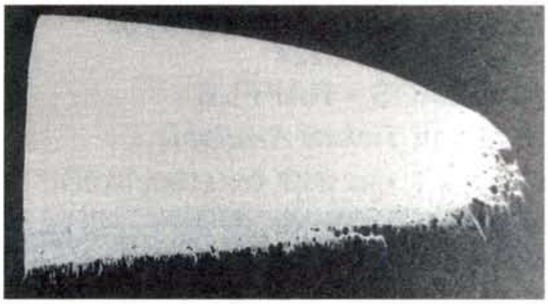
1 *Here's what you'll need to produce our elliptical foam-core wingtip: a root template, a foam block of sufficient depth and a template for the tip outline.*



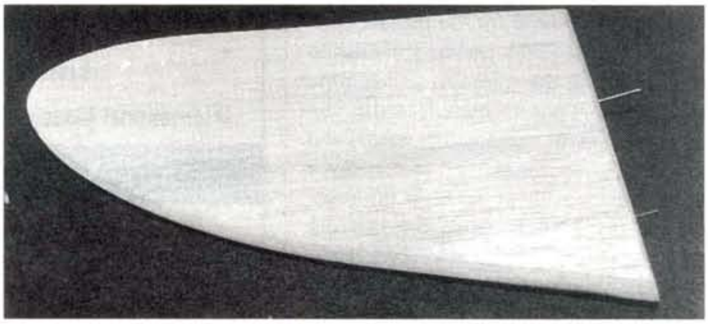
2 *Draw a center line (C/L) at the root and tip ends of the core. Align the root template C/L with the core C/L, and attach it with pins or small nails. Trans-fer the wingtip outline to the foam. We've successfully cut tip core airfoils before and after cutting the tip to the proper outline. The choice is yours.*



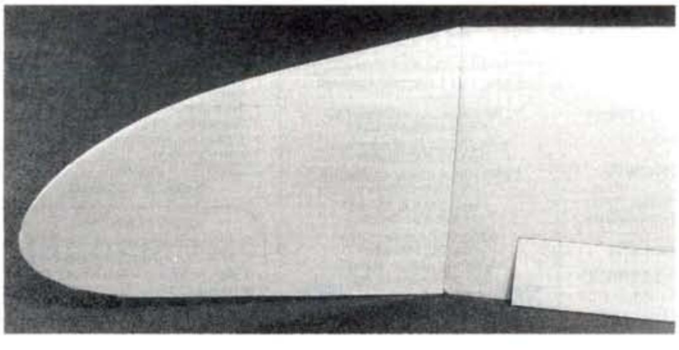
3 *Use a metal straightedge for the tip template. Align the upper surface of the straightedge with the core's C/L. Cut the core using as little heat as possible as the tip tapers to a feather edge.*



4 *The finished core. You can see that the foam at the tip is wafer thin; the airfoil "transitions" from the root template airfoil (SD 7037) to a flat plate.*

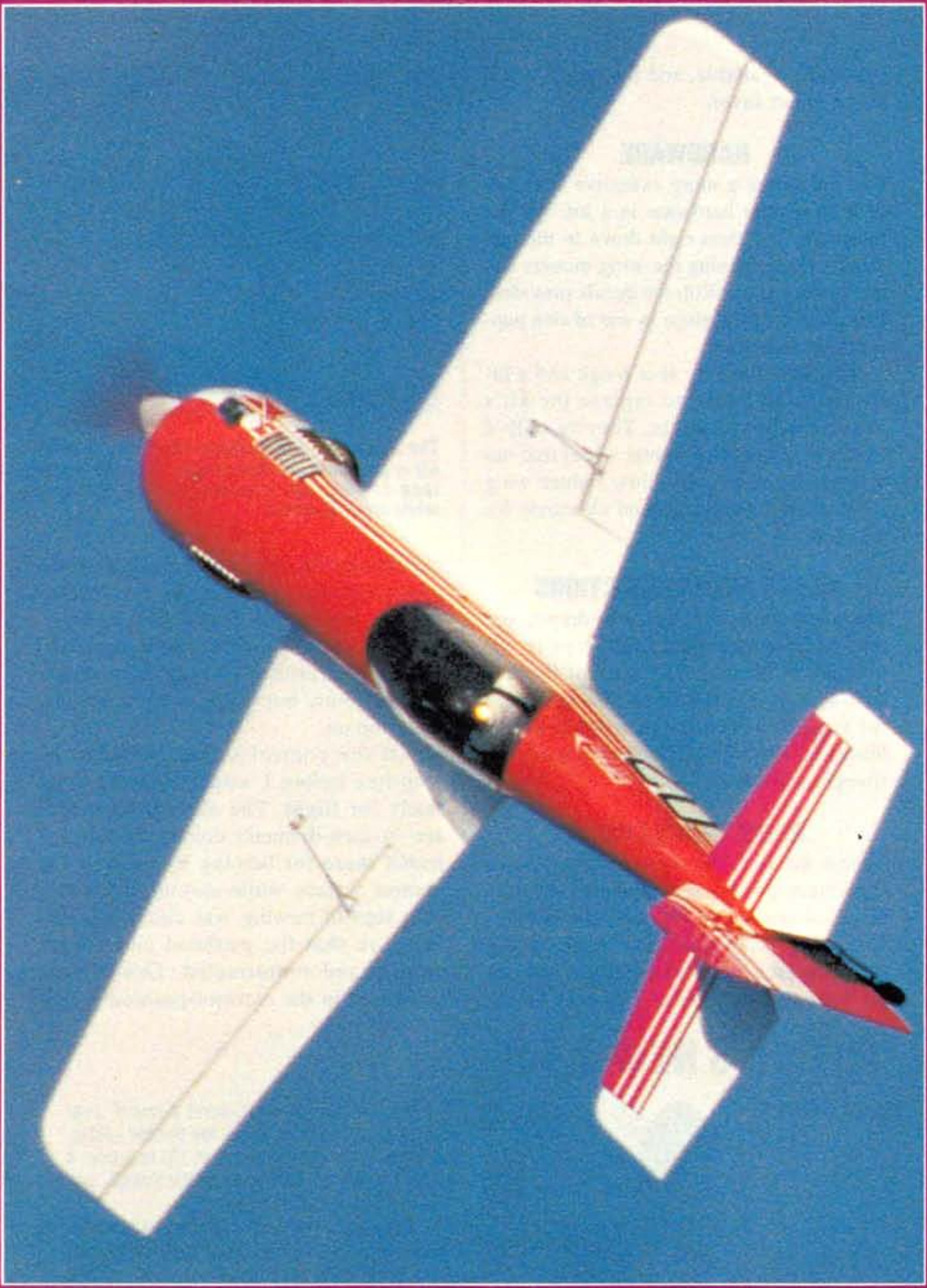


5 *The ready-to-cover elliptical wingtip. Install the sheeting using your favorite method. We like to use double-sided tape. Allow the sheeting to overlap the trailing edge by ¼ to ½ inch, depending on your choice of airfoils and the thickness of the sheeting material. We use a ¼-inch-square leading edge and feather it into the tip.*



6 *Our elliptical wingtip installed on a Chuperosa wing. The tip adds a nice visual touch, it improves flight times, and it nearly eliminates the possibility of tip-stalling.*

FIELD & BENCH REVIEW



Byron Sukhoi SU-26M & Webra 4.4

by David Baron

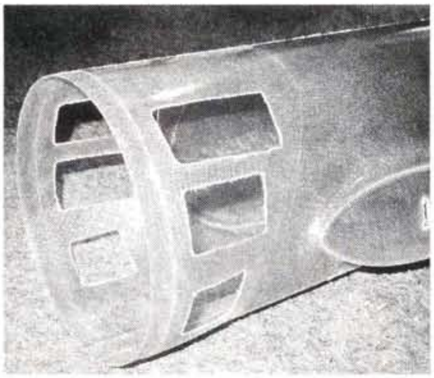
New levels of power and performance

THIS AIRCRAFT'S full-scale big brother is the king of the airshow circuit. No other plane possesses its awesome power and performance. It's this incredible performance that fuels the modeler's desire to build scale models of this plane, yet even our models fall short of the power-to-weight ratio of the full-scale version. The marriage of the Byron* Sukhoi to the new Webra* 4.4ci. engine probably makes this the first combination of superb design and outrageous power to come close to emulating the full-scale Russian superplane.

KIT QUALITY

• Die-cutting. The plywood parts are very well cut—not so much that they fall out in the box, but just enough for them to loosen when scratched with a razor on the side opposite of the original cut. With this, the pieces can be pressed out simply and need almost no deburring. The quality of the plywood is very high.

The author poses with his latest giant-scale aerobat.



Early view of the fuselage shell with louvers cut out.

• Balsa selection. The balsa is limited to the sheeting for the wings and the blocks for the tips of the flying surfaces. It's of the proper weight and density for the job. My only problem was with the sheeting; the edges needed a lot of attention to make them true enough to be joined to the large sheets for the wing skins.

ENGINES AND PROPS

Byron is very cautious about recommending engines over 4ci, owing, mostly, to propeller clearance problems because larger engines need props with diameters of more than 22 inches. Because of the great interest in giant-scale racing, I believe that prop selection is getting better all the time. High-pitch, 22-inch props and three-blade props are becoming available, and the benefits will all be in our favor.

HARDWARE

I've yet to see a more extensive selection of high-quality hardware in a kit. All the items are first-class right down to the ball drivers for tightening the wing mounts and the landing gear. With the decals provided, you can trim your plane in one of two popular color schemes.

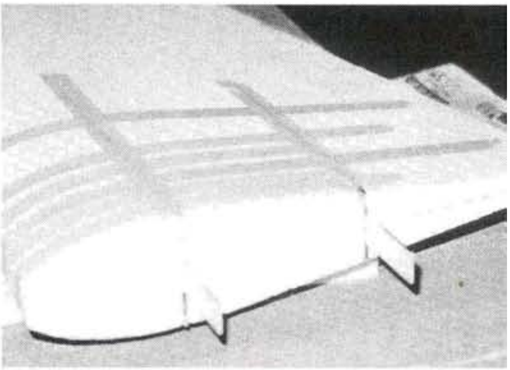
The field that I fly at is rough and a little short, so I plan to replace the kit's heavy Du-Bro* wheels. They're only 4 inches in diameter; a lighter wheel that has a larger diameter will allow lighter wing loadings and greater ground clearance for the prop.

PLANS AND INSTRUCTIONS

The plans sheets are very well-drawn, and they help in visualizing the steps in the instruction manual. The manual itself is well-written. It's full of options and helpful suggestions to make construction a learning experience for newcomers to fiberglass and foam.

RADIO INSTALLATION

I chose the JR* 388 radio. For the sake of maximum power and minimum slop, I installed one servo for each control surface. That meant that there would be one servo for each half of the elevator and one for each aileron. I use a Y-harness for the elevator and the differential function of the programmable radio for the two aileron servos. The plane contains five high-quality servos and a sixth standard servo for throttle. This may seem excessive to some, but this model is not one to skimp on.



The aluminum and plywood wing spar assembly is glued into the foam-cores. Note the use of tape to keep the pressure against the spar while the glue cures.

All the control surfaces had to be slop-free before I would consider them ready for flight. The elevator pushrods are ¼-inch-diameter composite tubes. I tested these for bowing by holding the control surface while moving the servo. Any sign of bowing was cured by making sure that the pushrod paths were straight and unobstructed. This is most important in the elevator-pushrod instal-

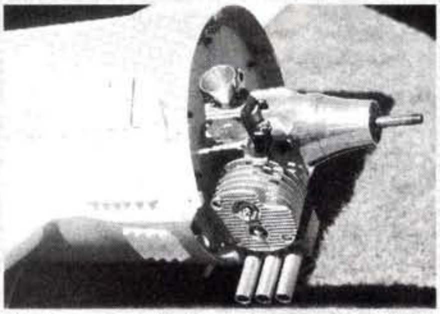
WEBRA'S NEW 4.4ci

In case you're not familiar with this engine, please review our coverage of the Reno Unlimited Races in the October issue of *Model Airplane News*. This engine placed second and fifth in the Gold Class. This qualifies its power and performance better than anything I can say.

It's a little intimidating when you hold it in your hand, but once it has been mounted in your aircraft, it takes on a presence of its own. When the engine has been fueled and primed and you attempt to pull it through compression, its 75cc displacement is unmistakable. It kicks like a mule, but, in reality, this is the secret of starting it. If all engines were like this one, the electric-starter business would have never got off the ground.

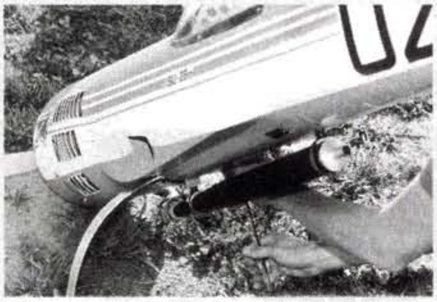
STARTING THE WEBRA 4.4

• At full throttle, twist the choke a quarter turn and turn the engine over manually until you see fuel in the fuel line. Then continue until you hear the fuel in the carburetor.
• Set the throttle to idle, and make sure that the engine is between compression strokes.
• Attach your ni-starter to one of the glow plugs, grip the spinner—*not the propeller*—and vigorously snap the spinner back so that the assembly bounces off the compression stroke. This starts my engine every time!
• After the engine has run for a few seconds, return the choke to its normal position.



The awesome Webra 4.4 swung our 22x10 Dynathrust* test prop at more than 9,000rpm.

To suppress the roar of the Webra 4.4, you can't beat the Davis Diesel QP290 giant-scale quiet pipe.



If your engine is warm, don't prime it. Just hook up your ni-starter, check the throttle setting, and bump it against compression. On occasion, it will start backward. Simply close the throttle, and run through the procedure again.

Always have a trusted assistant to hold the plane any time the glow plug is attached, and immediately after you snap the spinner against compression, get your hand out of the way! This engine doesn't sputter to life; it *roars* to life.

WEBRA 4.4 NOTES

• **Fuel:** the engine burns 5-percent-nitro and 3- to 4-percent-oil fuel. (Create this mixture by diluting a gallon of 15-percent, 4-stroke fuel with two gallons of high-grade methanol.) Fuel consumption is high—about 5 ounces per minute—so expect to use at least two 24-ounce tanks to feed it.
• **Prop selection:** Dynaflite* 22x10 and APC* 22x12 through 22x14.
• **Glow plugs:** two K&B 1L.
• **Mufflers:** with the stock muffler, the plane sounds like a Harley Davidson running open headers. This setup is only for flying sites with no noise restrictions.

On a quieter note, Davis Diesel Development* offers a muffled tuned pipe that can soothe the beast. This unit makes it no more objectionable than a stock 4-stroke 120. If your club field is like mine, this arrangement is a necessity. Davis also offers a full line of headers to suit any engine installation.

PHOTOS BY WALTER SIDAS, TOM ATWOOD AND GERRY YARRISH

lation. For the rudder, the pull/pull system is adequate, but on excessively hot or cold days, it can suffer slightly from expansion or contraction.

BATTERY

I use a 5-cell, 1500mA airborne pack. I like 5-cell packs in environments in which maximum servo power is an issue, such as when you're flying maneuvers that put a heavy load on the servos. In maneuvers such as the Lomcevak, the full stalled current drain of a single servo can rise above ½ amp.

CONSTRUCTION

I hadn't built a Byron kit before, and the fiberglass and resin that they use to mold their fuselage was unlike any that I'd experienced. To produce a high-quality glue joint, the instructions suggest that you use heavy-grit sandpaper and 30-minute epoxy to install the formers, the bulkheads, the servo trays, etc.

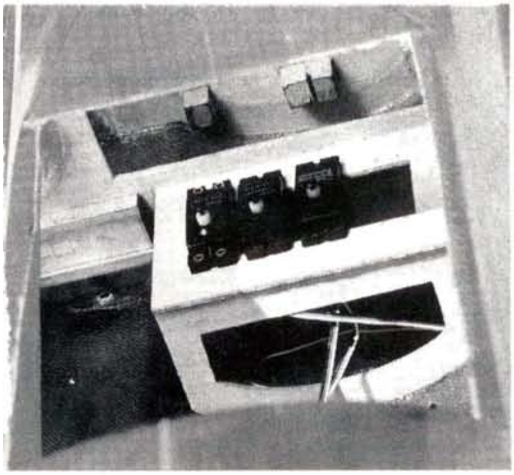
They also suggest that you use a polyester resin and strips of fiberglass cloth to reinforce these joints. I found it best to first rough up the area to be glued and then to wipe it with an acetone-dampened cloth until it felt sticky. I then glued the joint according to the instructions.

WING

Take care to keep the foam wings and saddles in good shape. They're needed in construction and will remain the best possible place to store your wings.

Take your time when you mount the wings on the fuselage. Double-check for accuracy when you install the aluminum spars in the wing and when you cut the holes for the spars in the side of the fuselage. When you install bulkheads F-4 and F-5, remember that the aluminum wing joiners must be on the rear side of bulkhead F-5 and on the front of bulkhead F-4.

The servo tray seen through the cockpit opening.



SPECIFICATIONS

Manufacturer: Byron Originals
List price: $519.95
Type: giant-scale sport (27 percent)
Wingspan: 82 in.
Chord: 16½ in. (average)
Length: 72 in.
Weight: 22 lb.
Wing area: 1,340 sq. in. (9.39 sq. ft.)
Wing loading: 35.78 oz./sq. ft.
Power req'd: 3.5 to 4.5ci
Engine used: Webra Bully 4.4
Prop used: 22x10 through 22x14
Construction material: Fiberglass fuselage, balsa sheeted foam wings
Washout built in?: no
No. of channels req'd: 4 (aileron, rudder, throttle, elevator)

Comments: this superb, aerobatic airplane comes in a complete kit. The hardware is excellent, and building instructions are well-documented. Coupled with the new Webra 4.4, this giant-scale aircraft offers an entirely new flying experience. It's unsurpassed in emulating the performance of its full-scale counterpart.

Hits
- This airplane offers truly exceptional aerobatic performance, particularly with a high-powered engine.
- Instructions are thorough, well-organized and well-illustrated, and they offer many construction options.
- The hardware is of excellent quality.

Misses
- The plans and instructions should describe installation of a wider variety of suitable giant-scale engines.

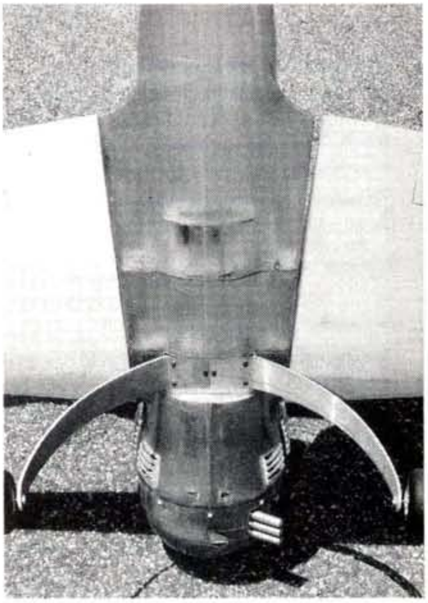
WEBRA 4.4

Hits
- Incredible ease of starting
- Fantastic power range exceeds that of other engines of similar displacement.

Misses
- None (but don't expect fuel economy with this much power).

Gluing in the aluminum wing joiners is a critical step. At this point, you should have the fuselage set up on blocks and the dihedral set for 0 degrees.

Before gluing, the aluminum blocks are only clamped in. When you're ready to glue, disassemble the wings again and make sure that the position of the holes in the side of the fuselage aren't pulling the wing spars away from their mounts in the fuselage. The top of this joint is critical because, when the wing bolts are tightened, the spar is pushed to the top of the



Note the landing gear and wing-spar assembly passing through the fuselage.

aluminum wing joiner.

Before you glue the aluminum wing-mounting extrusions to F-4 and F-5, make sure that you grease the aluminum wing spar/joiners with petroleum jelly; this prevents the 30-minute epoxy that oozes from the bulkhead from gluing the wings to the fuselage.

AVOIDING AILERON FLUTTER

Although I had heard rumors about flutter problems with this kit, I felt that most were builder-induced problems caused by poor hinging, choice of servos, or lackluster flight-control installations. This aircraft's ailerons are so large that you can't take for granted the amount of force necessary to move the surface. I chose the JR-4721 servo. With almost 120 ounces of torque, this is their "ultra-torque" servo. Linkages should be trusted to nothing less than a 4-40 solid rod. The kit's extra-large Du-Bro hinges must be installed using great care to maintain proper spacing, alignment and the integrity of the bond. Pinning the hinges after installation is a must.

Since mid-1992, these kits have included stiffer aileron control horns (solid wire instead of a threaded rod) and counterbalances to further reduce the likelihood of flutter. I used the improved solid wire, but I haven't tried the counterbalances yet. After running through six gallons of fuel with an engine capable of unlimited vertical performance at half throttle, my ailerons are wonderfully sensitive and show no tendency toward flutter.

MOTOR INSTALLATION

There are so many options for power systems that I wish Byron offered more suggestions for special engine installations.

FLIGHT PERFORMANCE

• Takeoff and landing

The Sukhoi definitely created a planeload of butterflies in my stomach on the day of its first flight. I chose a field in which I could safely set it down again in almost any direction. This proved to be unnecessary, however, because the plane literally leapt off the ground before I even reached half throttle. I had been advancing the power gently so that I could anticipate how much rudder would be necessary to counteract the engine's torque. The trims required were a little right aileron and down-elevator—both in such small quantities that the deflection isn't noticeable when the plane is sitting on the ground.

Taxiing is a breeze; just make sure that the idle is low enough to allow you to slow down to a stop without killing the engine. A 22-inch prop creates a lot of breeze at idle. As power is advanced, only a little rudder is required to keep the plane on the center line of the runway.

To say that this plane climbs with authority is a gross understatement. Even at one-third throttle, it climbs with authority! At full throttle, it has the radical acceleration of a fun-fly plane! The wide stance of its landing gear handles the power and torque well, but use care when "firewalling" the plane from slow flight; it may roll over on you!

The stall can sneak up on you and cause a belly flop of a landing. I get the aircraft close to the deck and very slowly flare it to the three-point position while I try to keep it 6 inches off the ground. This procedure uses a lot of runway, but it yields a perfect landing every time. The ailerons remain sensitive all through the flare. Owing to the lack of prop clearance with a 22-inch prop, wheel landings are discouraged.

• Low-speed performance

I've experimented with some very excessive elevator throws and have yet to induce a violent stall in this model. One Sukhoi owner told me that his had a snap-roll tendency, but it's my finding that if you carefully adhere to the center-of-gravity limits on the plans and the weight of your model doesn't exceed the recommended range, then you can expect the mellow stall characteristics of a trainer. One side note, however: when the plane *does* stall, it enters a mush that loses a fair amount of altitude before the nose lowers itself. If you detect the onset of a stall, you must be ready to force the nose down, or the plane could pancake to the ground, and you'd have to replace the prop (at least)!

• High-speed performance

I estimate that the model has a range of 20 to 80mph. Throughout this range, all controls are crisp and smooth and the plane tracks beautifully in pitch.

If the model has been set up according to the instructions, there's no danger of a high-speed stall. This plane enters a loop so tightly that a fun-fly plane would have trouble following. This attests to the integrity of the Byron wing-mounting system!

• Aerobatics

This plane does everything. It requires only a hint of pressure to maintain inverted flight, and it tracks like an arrow. I've never had a plane get so wound up in Lomcevaks. If you've had a chance to see the full-scale Sukhoi in an air-show routine, you'll have an idea of just how much hot-dog potential there is.

The only negative comment in an almost-perfect report is that the nose drops with large amounts of rudder deflection. Four-point rolls and knife-edge flight require a fair amount of up-elevator to maintain heading. I've gone so far as to permanently program up-elevator trim any time I exceed half-rudder deflection.

Their own Purrr Pow'r mount uses two firewalls, and this gave me the idea for mounting the Webra 4.4.

I created a stringer system that shared the load of the first (F-2) and second (F-3) firewalls. These stringers are of high-quality 1/8- and 1/4-inch plywood, and they were fiberglassed onto the side of the fiberglass fuselage. Each is at least 1 inch wide and extends beyond each firewall by 1/2 inch. I notched both firewalls and the stringers so that they lock together.

Wings can be plugged in easily at the flying field.

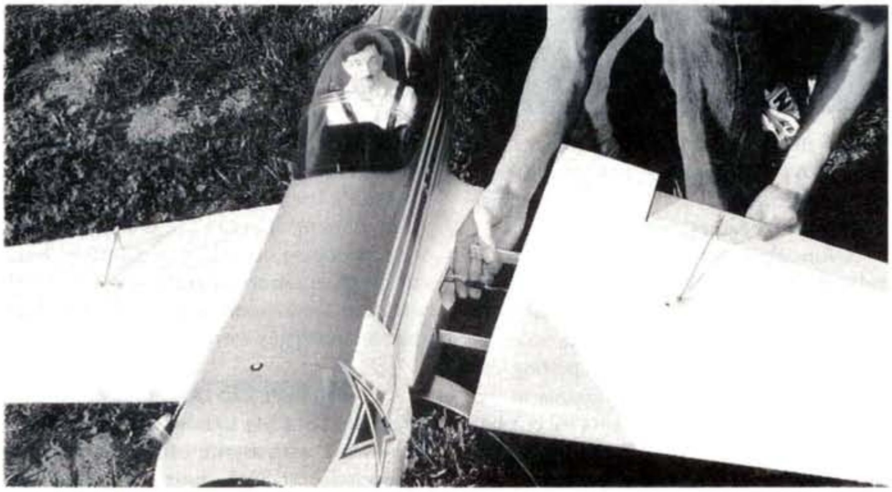
I mounted the engine on a set of Cirrus Ventures* vibration isolators. They have a durometer reading (a measurement of rubber density) of 50, and so far, they've worked out very well.

COVERING AND PAINTING

In the interest of saving weight and time, I elected to cover all the balsa-sheeted components with MonoKote* and to paint all the fiberglass areas with K&B* epoxy. The finish that I ended up with is acceptable, but I'll probably go with a computer-matched automotive paint next time I attempt to match such a bright color. The K&B primer and paint adhered well to the fiberglass parts.

CONCLUSION

This aircraft is a dream to fly; I've never had an aircraft that begged to be flown like this one. It's without peer as a crowd pleaser, and any modeler who sees it fly will yearn to take the transmitter from your hands. The day that I botch up and damage it will be a very dark day in my flying career.



**Here are the addresses of the companies mentioned in this article:*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
Webra; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*
JR Remote Control; *distributed by Horizon Hobby Distributors (see address above).*
Cirrus Ventures, *115 Hunter Ave., Fanwood, NJ 07023.*
MonoKote/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
K&B Mfg. Inc., *2100 College Dr., Lake Havasu, AZ 86403.*
Dynaflite, *1578 Osage, San Marcos, CA 92069.*
APC Props; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*
Davis Diesel Development, *Box 141, Milford, CT 06460.*
Dynathrust Props, *2541 N.E. 11th Ct., Pompano Beach, FL 33062.* ■

AstroFlight News

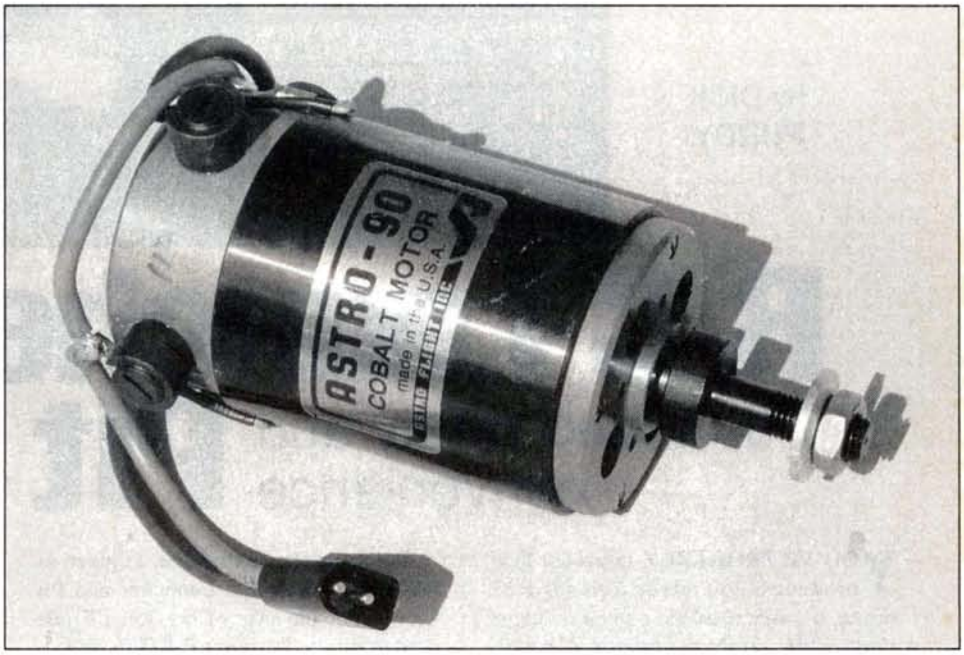
AstroFlight's New Cobalt 90 Motor

Team Astro is proud to introduce its new Cobalt 90 Motor. The Cobalt 90 is an excellent match for smaller quarter-scale airplanes with a gross weight of 12 to 16 pounds, and 1000 to 1400 square inches of total wing area.

The new Cobalt 90 is only 2 inches in diameter and 3 1/2 inches long, and weighs only 28 ounces. It is designed to run on 32 to 36 nicad cells.

There are several quarter-scale models currently using the Cobalt 90, including Bob Benjamin's Ace Big Bingo, Tony Fiori's P-51 Mustang, and Keith Shaw's Percival Mew Gull.

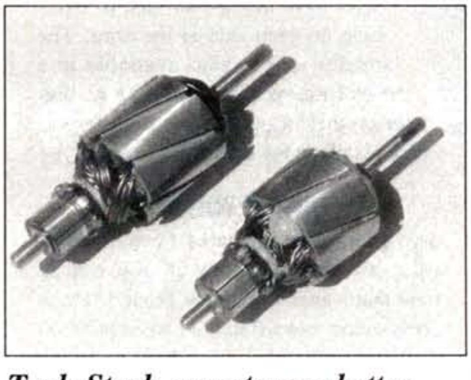
The Cobalt 90 would be a good match for powering other models, such as the Great Planes Ultra 1000, the Sig 1/4 Space Walker, and Dave Patrick's new Carl Goldberg Finesse 120 pattern kit.



The new Cobalt 90- a perfect choice for many quarter-scale planes.

Team Astro's "Tach-Stack" Armatures

Now, many of AstroFlight's high-performance racing motors come with precision-trued, "Tach-Stack" armature stacks. Tests have shown that by truing the outside of the armature stacks, the motor's balance and concentricity improved, resulting in more RPM's and higher overall performance. The "Tach-Stack" armatures are available separately for updating your current Team Astro racing motors.



Tach-Stack armatures : better balance, higher RPM.

For more information, see your hobby dealer or call AstroFlight directly at (310) 821-6242.

Coming Soon :

• The smallest, lightest electronic speed control ever produced! Team Astro's new Model 217 "Micro" speed control.

• Revolutionary, new "Hi-Rev" composite brushes. Made of two different conductive materials!

• New titanium-shaft FAI-60 motor!

Astro Flight, Inc. • 13311 Beach Ave., Marina Del Rey, CA 90292

PRODUCT REVIEW

by DICK PURDY

Provided by Boeing Hawks member Larry Wheat, this photo shows club members at their flying field near Kent, WA. Larry comments: "We have found these devices very helpful, not only with the safety aspect, which the Boeing Co. emphasizes, but also with the sheer convenience they offer. You don't need another person to hold your airplane while starting, etc."

R/C Launcher and Pit Crew

For added safety and convenience

YOU'VE PROBABLY noticed a new product being advertised for R/C pilots. It's described as a being a device that's "designed to change the way people fly."

The idea behind it is to provide a safe, reliable, easy way to restrain a model airplane while a pilot starts the engine and readies it for flight. This product relieves a pilot of the need to seek help from a buddy. I was recently given the chance to try one of these new devices and to provide a candid evaluation of its performance.

The Launcher right after installation. It takes only a few seconds to set up the device.

The full name of this unit, as given in the ads, is "The R/C Launcher and Pit Crew." For the sake of brevity, I'll just reduce that to "Launcher." The unit is available in two sizes; I tested the larger one, which was designed for R/C planes up to 1/3 scale. The Launcher measures 9 1/4 inches wide by 26 1/2 inches long. The width of the space between the safety arms of the large and small versions of Launcher is about 7 1/2 inches.

How small a plane will it accommodate? I recommend that the full tip-to-tip span of the stabilizer have at least an inch of overhang on each side of the arms. The smaller unit is also available in a control-line version, and, like its bigger brother, it permits the pilot to prepare his plane for launching unassisted.

HOW IT WORKS

The Launcher operates very simply, using two arms that pivot up from a fixed base that's anchored to the ground. These arms swing upward into a locked position to restrain the plane's stabilizer during the preflight mode. The arms swing up to more than 12 inches above the ground, and they straddle the fuse. The plane is held at the leading edge of the stab, and sections of foam padding surround the arms to cushion it.

When the pilot is ready to go, he touches a release pedal with his foot to unlock the two arms. The thrust of the engine and prop is sufficient to pull those arms forward, and they fall flat on the ground. The plane is then free either to taxi out, or to begin a takeoff run. The control-line pilot operates his planes' release with a long cord that's attached to the pedal, and this permits him to stand at the center of his flight circle, ready to fly when he "pulls the trigger" himself. There's a simple safety feature on the release pedal to avoid inadvertent activation.

The base, arms and release pedal are all constructed of a sturdy, highly visible colorful plastic material. The base is molded of 25-percent-glass-filled polyethylene material, and the arms, pedal and other composite components are 33-percent-glass-filled virgin nylon. All the parts are "UV-stabilized" to resist being weathered by the sun. Two heavy-duty flexible cables connect the pedal to the arm releases.

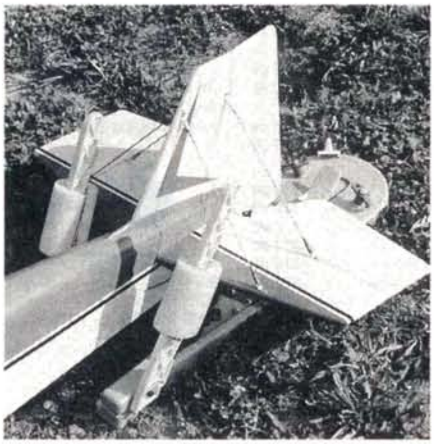
IN THE FIELD

I have used this simple, but effective, device several times now, and I'm convinced that it is just as safe as having a friend help you; in fact, the noise of an aircraft engine can be more than enough

Compared with the risks taken in the pit areas of most flying fields, this is a modest investment to help minimize the chance of serious injury.

to drown out communications between a pilot and his helper, and that can lead to misunderstandings and, possibly, disaster. The unit eliminates this potential for accidents.

When a pilot takes the Launcher to the flying field, he'll also need a hammer. Four 8-inch steel spikes are driven into the ground through holes in the base platform. Nothing in the R/C hobby can be assumed to be "foolproof," I'm sure, but I think the Launcher comes close. It is certainly easy to use in every respect, and it's so well-built that it should last indefinitely. Without question, the Launcher is a high-quality item.



The Launcher restrains a Lanier 120 Stinger that Dick built for a "Model Airplane News" review.

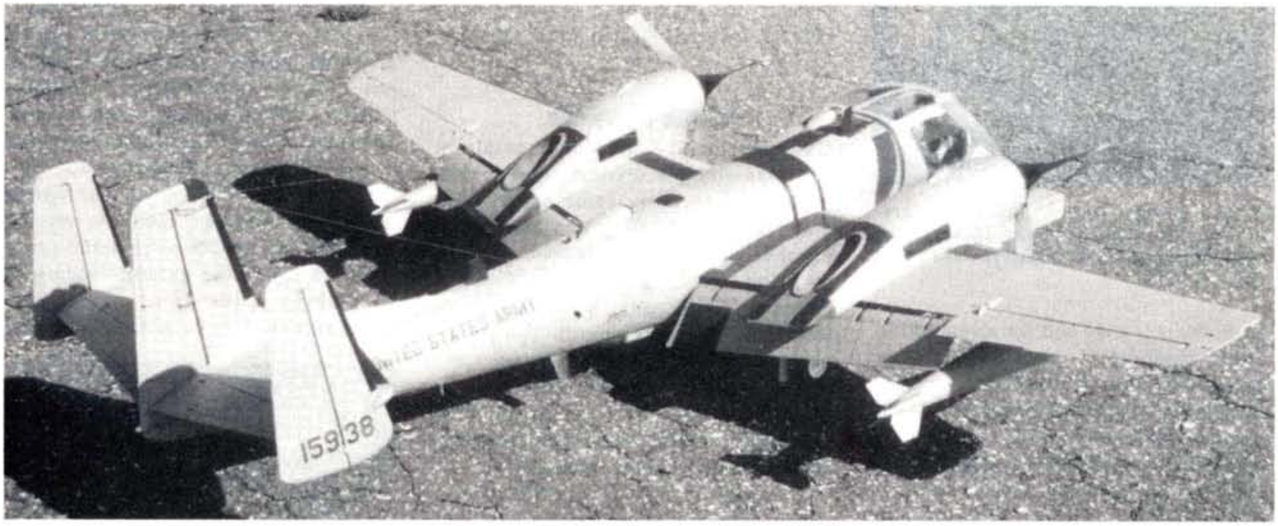
The ads don't reveal the price of the Launcher, so you might be curious, as I was, about that particular detail. There's a phone number to call for price and ordering information, and it's included at the end of this review. The list price for the larger R/C unit is $119.95, but it's currently available in stores for $89.95, while the smaller unit costs $69.95. Compared with the risks taken in the pit areas of most flying fields, this is a modest investment to help minimize the chance of serious injury.

If you're committed to safety, as you should be, call Mr. Gary Swaney, the designer/manufacturer of the Launcher, to place your order. This could be one of your smartest hobby purchases.

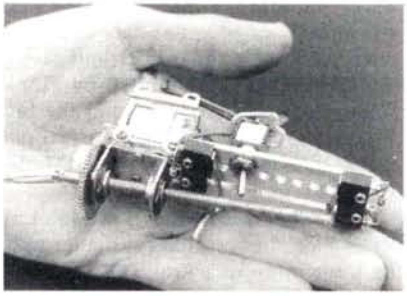
**Here's the address of the company that's featured in this article:*
Launcher Co., *5806 Lancelot Ct. S.W., Olympia, WA 98512; (206) 786-8461.* ■

FRANK TIANO

OLD AND NEW MODELING TREASURES



IT'S AMAZING how long it sometimes takes to get some feedback from a particular subject that we've covered in this column. A good example was the extra coverage some of you desired about entering competition. That really blew me away, because, for years, I was told that the majority of scale modelers really couldn't give a hoot less about competing. Maybe the popularity of IMAA, QSAA and AMA sport-scale fun flys have done something to change the way many of us feel. In any event, this month I share some information on a couple of outstanding airplanes by a couple of outstanding modelers, a few new doodads and a couple more sources of scale documentation and plans.



The Janaco servo comes wired with limit switches and an installed toggle switch. Stock travel is 1¾ inches, but servos can be custom-made to allow more travel. The 4-ounce unit will work 120 times using a 9V transmitter battery!

FLAPJACKS

Doodads first. I'm currently finishing up an exact-scale, ⅙-size P-47 that was drawn up for me by Dave Platt*. Depending on the outcome of several experiments, this may or may not become a new kit sometime in late 1994. Anyway, the purpose of mentioning Dave's name is not to get him a free plug, but rather to notify all of you Thunderbolt maniacs that this is purely an experimental adventure; it isn't anywhere near ready for sale. So please get that index finger away from that dial pad!

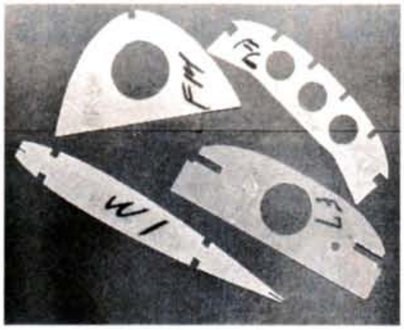
Getting back to the Jug; as you probably know, it has really neat Fowler flaps. These flaps sort of pop downward as they travel rearward, and they end up with the leading edges of the flaps quite a bit farther back in the extended position than they are in the up (retracted) position. I originally installed a new Airtronics* Infinity radio in the Jug and found that their new heavy-duty, lower-profile servo was more than strong enough to operate the flaps, but it was lacking in throw.

After playing around with output arms in several lengths, I almost settled for whatever flap travel I could get. Then I remembered reading about a jackscrew servo a few months ago in one of the F-Troop's (a southern California warbirds-only club) news-letters. To make a long story short, I ordered a couple,

There aren't any bad views of a Mohawk; there's something interesting from every angle. Here's a good look at the Fowler flaps, the exhaust outlets and the triple tails.

installed one in the P-47, and now I have all the travel I need. As a bonus, the flaps make a cool sound as they are activated, and they move at just the right speed. In a nutshell, the servo operates from a standard 9V battery, and it has almost 8 pounds of thrust while moving 1¾ inches in a straight line in 8 seconds. The servo can put out even more power with more voltage! The unit weighs just 4 ounces and may be used for a variety of functions: flaps, landing gear, camera cocking, bomb drops, or whatever your

This is what a Fowler flap looks like in the extended position. A Janaco jackscrew servo allows 8 seconds of travel time.



Here's a collection of See Temp templates. Just put them in an envelope for safe keeping and you'll always have spare parts in a jiffy.

heart desires. They sell for about $80 in the configuration I asked for, and they come wired with all the proper switches. Jack Stolly—the owner of Janaco*—will custom-make travel servos at a nominal charge! For years, we've heard about these servos, and now you've heard it firsthand from someone who not only uses one but is quite pleased as well.

TRANSPARENT TREASURE

While working on the P-47, I recently rediscovered See Temp*—a frosted, see-through material that is absolutely ideal for making templates of parts that you want to duplicate. Simply place a piece of See Temp over your plans and tape it into position so it will not move. Next, using a ruler or a French curve, trace the part you wish to duplicate with a sharp, no. 11, X-Acto* blade. Once scribed, See Temp will release the traced template with just a simple flexing action. If you're making more than one airplane, e.g., for a club project, or if you want to keep templates of your current scale model in case of damage, See Temp is a very valuable yet inexpensive product to have in your workshop. A 21½x51½-inch sheet sells for just $5!

Not one detail has been omitted from Charlie Chambers' Bearcat. The dummy engine was handmade, and each aluminum panel was put on individually. All the markings are painted with K&B* epoxy.

PLAN SOURCES

I've mentioned scale documentation and plan sources several times in the past, but I recently came across one that I had totally forgotten about and another that really deserves another mention. First, there's Jim Kiger's company, Replicraft*. No, I didn't say Replitech. I said Replicraft. This company is so unusual because they specialize in WW I aircraft only. Now, I gotta tell you—these drawings will absolutely impress you the minute you slide them out of their envelope.

Depending on which aircraft you chose, you might get as many as six sheets of detailed stuff that you could undoubtedly build a full-scale airplane from! The drawings average $45 a set and are touted as being absolutely authentic. The choices include a Sopwith Camel, a Pup, a 1½ Strutter and Triplane, a Roland DV1, a Thomas Morse Scout, a Hanriot HD 1 and others. Best of all, a self-addressed, stamped envelope and a brief note saying that you saw the information in *Model Airplane News'* "Sporty Scale" will get you a listing for free!

The other company is called, simply, Bob Holman Plans*. I just received Bob's new catalogue yesterday, and it is truly chock full of plans for just about any subject you can imagine. Especially interesting is that Bob now offers kits or semi-kits of several imported designs that have been blown up to 76 to 82 inches. His catalogue costs a mere $5 and is worth every dime.

SHOW AND TELL

The first of two exquisite airplanes I'd like to share with you this month is the well-known Grumman Bearcat built by the also well-known Charlie Chambers. Charlie used a set of plans drawn by Jerry Bates* to produce one of the most realistic models seen to date. It even outshines that famous Mustang he campaigned for a number of years.

The big cat spans 78½ inches and is powered by a Super Tigre 4500—that's 2.7 cubes, turning a Zinger 20x8 prop at just 7,800 on the ground. A homemade muffler puts the exhaust out of the scale openings. The all-aluminum-covered model weighs just 28 pounds and flies very well—now that Charlie has figured out that the metal the model is covered with was giving his radio some problems owing to the antenna location. Everything is just fine, and Charlie hopes to do well at the next Masters and Top Gun with this beautiful aircraft.

Flex the See Temp back and forth to remove the traced part from the sheet. For "innies," simply write the information right on the See Temp.

For those interested, the reason you don't see an advertisement for Jerry Bates is simple: he doesn't advertise! Jerry designs a new airplane only every couple of years and sells them by word of mouth. So for the particulars: Bates plans include a cockpit canopy and fiberglass cowl. The articulating retracts, a scale tail-wheel unit and a dummy engine are supplied by Frank Tiano Enterprises (FTE)* and the big Tigre 4500 is supplied by your favorite hobby store through Great Planes Model Distributors*.

The other well-known modeler is Dave Platt, but his subject matter may be a bit more obscure. The Mohawk was also built by Grumman, but it served almost 20 years later as a counter-insurgency and spotter aircraft for the U.S. Army and Navy. Dave's airplane is completely scratch-built; no

Dave Platt's Grumman Mohawk is a true masterpiece. The longer you look at it, the more the detail pop out at you. The scale prop blades are for static display only, and they're in the "feathered" position. A side-looking airborne radar (SLAR) pod and external fuel tanks fly with the model.

plans will be sold for this model. It was designed with a spot on the U.S. scale team in mind. This means that according to FAI rules, this airplane must weigh less than 15 pounds, 6 ounces! Now get a load of this; Dave's project Mohawk beat the legal weight by one full pound! That's for a 1¾ inch to the foot model with an 84-inch wingspan, custom-designed and scratch-built tricycle retracting landing gear and two Enya .53 4-strokes for power. That computes to 1,102 square inches of area and a wing loading of only 30 ounces per square foot!

And speaking of landing gear, the famous Platt Competition Plus gear have recently received a big improvement. Current models will feature extra-heavy-duty, professional-grade air cylinders manufactured by Bimba or Clippard for years of leak-free service.

Back to the Mohawk—the entire project took exactly 10 months from the time Mr. Platt started to put pencil to paper to the first test flight. This airplane will be at Top Gun in '94, and I truly believe that the trip will be worth it just to get a look at this outstanding effort!

Well, it's time to go once again. Until next month, remember that any manufacturer who supports one of your club's events deserves a thank-you note. Often, this important follow-up is overlooked, and then we wonder why we get poor responses for the next event. Also, when responding to a scale manufacturer, why not tell him you saw his company listed or talked about right here in *Model Airplane News?* It sure helps manufacturers know which magazine is doing them the most good, and it sure helps us to keep this column stuffed full of new, neat material. And speaking of material, if you have an interesting new project you've recently completed, I'd love to have a picture of it for consideration in sharing it with our readers. Just send it to me care of FTE. Later, dude; your six is clear.

The Super Tigre 4500 in Charlie's Bearcat has more than enough power. Notice the homemade muffler and the scale exhaust pipes.

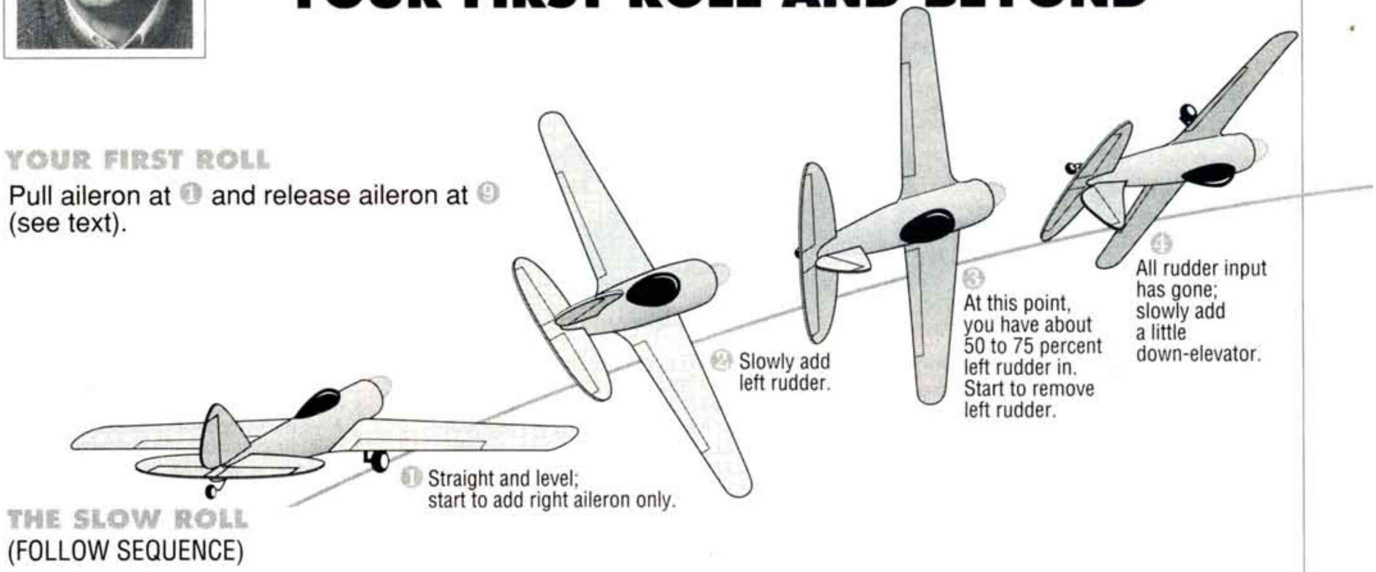
**Here are the addresses of the companies that are mentioned in this article:*

Dave Platt Models, *1306 Havre N.W., Palm Bay, FL 32907.*
Airtronics Inc., *11 Autry, Irvine, CA 92718.*
Janaco, *11323 Cotillion Dr., Dallas, TX 75228.*
See Temp, *P.O. Box 105, Sussex, WI 53089.*
X-Acto, Division of Hunt Mfg., Philadelphia, PA 19102.
Replicraft, *1400 Gomes Rd., Freemont, CA 94539.*
Bob Holman Plans, *P.O. Box 741, San Bernadino, CA 92402.*
Jerry Bates Plans, *102 Glenwood St., Mobile, AL 36606.*
FTE, *15300 Estancia Ln., W. Palm Beach, FL 33414.*
Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.* ■

AEROBATICS MADE EASY

DAVE PATRICK

YOUR FIRST ROLL AND BEYOND



IN MY LAST column, we discussed the importance of position, i.e., flying straight and level so that your plane is exactly where you want it to be—in any reasonable flying weather. You can't perform a maneuver where you want to if you can't start it where you want to start it. So don't be shy; practice flying straight and level. Remember, learning to fly aerobatics is done bit by bit. If you try to bite off too large a chunk, it can be overwhelming, and "brain overload" sets in. Trust me; it happens to all of us!

With that behind us, we're going to walk—or I should say fly—you through your first roll. (See also the June '92 issue of *Model Airplane News*, in which I discussed the details of a slow roll. In my next column, I'll use these building blocks to explain how to fly a very interesting maneuver: the rolling circle.)

WHICH PLANE?

If you're a beginner at aerobatics, let me say that it's important to have the right tools to do a good job. Most basic trainers, such as a Goldberg* Eagle, will get you through your first simple rolls. As you advance and want to perform good slow and point rolls, however, you should be flying a low-wing aircraft, such as the Goldberg Tiger 2, or one that's known to be capable of executing these maneuvers well. (There are many suitable aircraft available, but since I designed these, I am particularly familiar with these aircraft.)

In summary, the plane for learning slow and point rolls should have a fully symmetrical airfoil, with a mid wing or a low wing. The application of rudder in flight should produce little, if any, pitching or rolling. It would also be nice if the aircraft could sustain knife-edge flight, at least for a short period.

GETTING STARTED

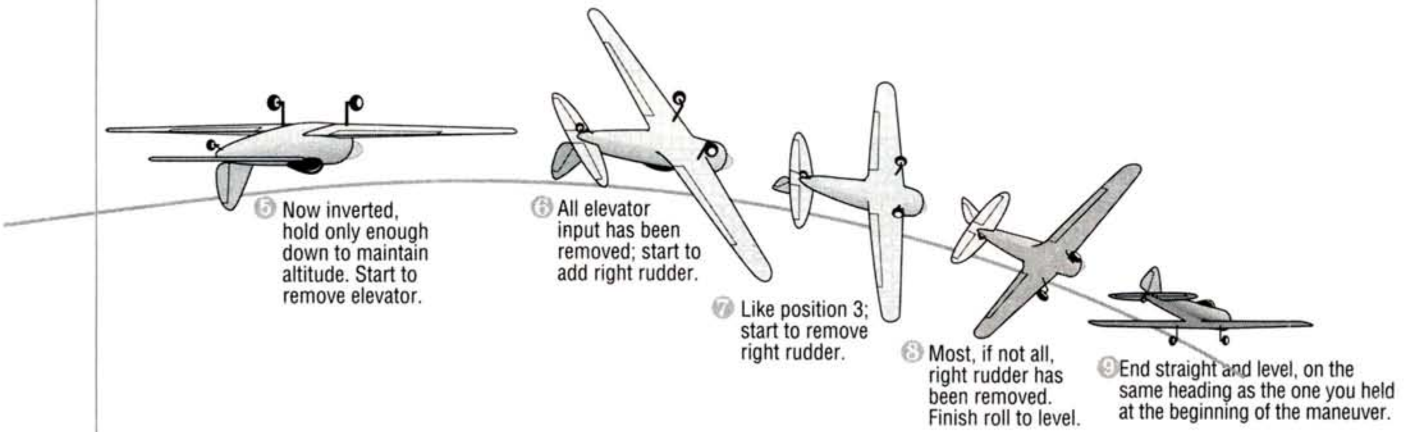
Before you even fuel up your aircraft, it's a good idea to "dry fly"—think through the maneuver in detail—on the ground, especially when you're trying something new. It may seem a little silly at first, but pretend your hand is your plane, and try to "roll" it through the maneuver. We all do it. For example, even at the T.O.C., you can see the best pilots in the world practicing unknown patterns with their hands or with little toy planes. It really works! Not only does it save wear and tear on your aircraft, but it also reduces the risk of losing your plane.

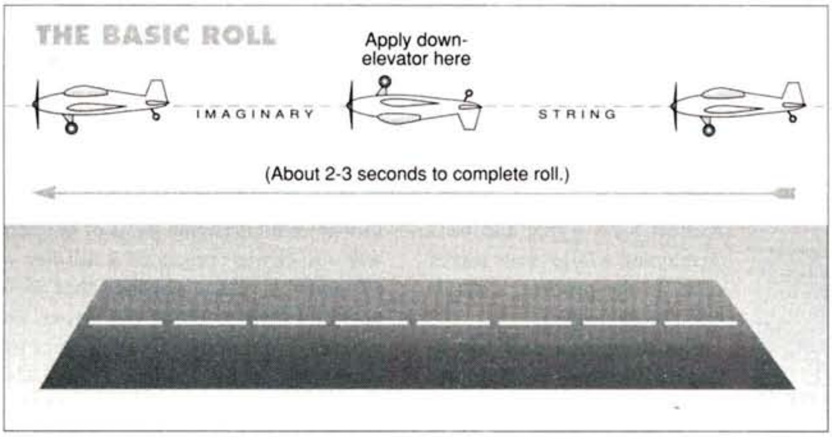
In any maneuver, the first step is to establish straight, level flight. Then, at full power, pull the nose up to about 15 degrees. Pause for a second or two to collect your thoughts, and apply full aileron only. Wait for the aircraft to go all the way around and back to upright, then release aileron when the wings are level—not before. Pilots who are doing their first rolls tend to stop halfway, so keep that in mind. Commit yourself to going all the way around and voila! It may not be perfect—yet—so do a bunch.

SOME HINTS

By the way, the reason for pulling the nose up before you roll is that during the roll, the nose will drop. Pulling up the nose helps you to end up on line with a minimum loss of altitude.

Another good hint is to do your first rolls in only one direction, e.g., rolling right starting from the right end of the field. Also, always roll in the same place so that you'll be presented with the same visual conditions. When you're comfortable starting from the right, you're ready to try a roll from the other direction. Keep in mind that most trainers take about 3 seconds to complete a simple roll. More advanced aircraft can





NOTE: to really add polish to your slow rolls, add some up-elevator at positions 2 and 8. This will help to correct a slight heading change caused by rudder, and it will help to keep the nose up. You might want to start your first slow rolls by pulling the nose up slightly and "arching" the maneuver. As you become more proficient, you'll straighten the line.

complete the maneuver in only a second, but that kind of roll rate should be reserved for other maneuvers, and it can also make it difficult to fly smoothly. In my opinion, 2 to 3 seconds should be ideal.

Now that you're getting pretty good at the simple roll, let's clean it up a bit. We're going to do things a little differently. First, don't pull the nose up before you start the roll; instead, as the plane goes through the inverted part of the roll, apply a little down-elevator. How much depends on the balance and type of aircraft. Typical trainers require 25- to 40-percent of down-elevator when they're inverted. A more aerobatic aircraft—especially one that has an aft CG—may need only 5- to 10-percent down-elevator. It's important that you time the application of down-elevator properly and that you apply it smoothly (see Figure 2). Again, practice entering the maneuver from different directions.

Once you're really comfortable with your roll, try doing two—or three—in a row. Once you've mastered this, there's no reason why you shouldn't be able to roll from horizon to horizon!

Now that you're happy with the full aileron roll, let's discuss how to get through your first true slow rolls. Although I went over the slow roll in the June '92 issue, it's such a difficult maneuver that it warrants a brief review.

To me, a good slow roll should take about 6 seconds to complete (in IMAC rules, it's less). This poses other problems, and the solution is the infamous rudder. The difference between the good pilots and the *great* pilots is their command of the all-important rudder. So, to really do the slow roll "on the wire," we need to add "top" rudder as the aircraft approaches the knife-edge position. By the way, just as we did in the simple roll, we still need to add a little down-elevator when the model is inverted.

Timing is everything, and when to apply the rudder and elevator (and how much) varies a great deal. See the illustration above for an idea of what happens in the slow roll—then try it out. The most common error is probably applying rudder too early. That yaws the plane off heading. Also, the elevator can change your heading if it's applied too early or too late. The slow roll is one of the most difficult maneuvers to really do well, and it requires a great deal of practice.

Well, that should about cover it; now, all you need is practice to build your proficiency. I don't believe in "natural ability," but I do believe in smart practice. Remember that learning to fly well is fun for everyone—not only the competitor! Now, the groundwork has been laid to look at rolling circles. See you next month.

** Here's the address of the company that's mentioned in this article:*
***Carl Goldberg Models,** 4734 W. Chicago Ave., Chicago, IL 60651.* ■

GOLDEN AGE OF R/C

HAL DeBOLT

FROM ROTOR BLADES TO REEDS

SOMETIMES WHEN we discuss a subject, follow-up input from readers fills in the voids. Thus, we need to go back and add this interesting info.

Nats-winning Alex Schnieder of the San Francisco Mustangs club with his renowned Schnieder Cub—a widely used early R/C model. It was equipped with a Rockwood (radio, of course).

NEW GYRATIONS

A while back, I casually mentioned the R/C autogyro. Your response was a surprise. You say that in this modern day, there's an urge to have something different, and to add to the scope of your flying. Gyros are great fun!

Let's commence with a nice letter from Bill Robinson of Spearfish, SD, who tells us he's flying a gyro that he built over the winter. Bill says that it took some getting used to, but now he enjoys the different way to fly.

Ron Clem of San Diego, CA, indicates that the original construction article ('tis a *Model Airplane News* plan) can help you understand how an autogyro works. Ron modified the model so that he can disassemble it for transportation: two-piece wing, detachable tail, etc. Even with the changes, he is happy to have a flying weight of only 4½ pounds.

Here's an excellent shot of Walt Good flying his TTPW-equipped Rudder Bug. Note the large, ground-based transmitter with its dipole antenna. It had to be oriented toward the model because it generated a weak signal from its ends.

Ron's helicopter experience led him astray. Although the drawing called for negative rotor-blade incidence, he thought that it should be positive. An autogyro rotor isn't powered; it requires negative incidence in the blades for the air stream to create rotation—and the result is lift. Gyros are a breed of their own! I should say that if you don't deviate from the plans, you shouldn't have any problems.

Marvin Leazenby of Anderson, ID, adds another color to the gyro spectrum. Marvin built a *Model Airplane News* gyro, and he enjoyed it so much that he started another major project: he obtained Bill Pinkston's drawings for the Kellett K2A gyro, and he's developing a large scale model of it. In the process, a major question developed.

The drawings call for 2-degree-positive rotor-blade incidence. From what we know, this won't work. Does anyone have any info in this regard? Might the drawings be incorrect? There's an obvious difference: the Kellett has an engine powered takeoff to bring the rotor up to takeoff rpm. Otherwise, a ground run is required to bring the rotor up to speed. Could it be that positive incidence was used when the rotor was powered, and when power was disconnected, the rotor automatically switched to negative incidence? Time does have a way of dissipating knowledge!

HI JOHNSON

Do you remember discussing Hi Johnson and his doings with Veco, Ken-Hi and then, more recently, Dynamic Models? Dick Wolsey of North Reading, MA, has provided us with more valuable information concerning Hi's engine operation.

To preface this, I must mention Henry Orwick and his engine gems of the post-war era. Orwick produced a full line of FF and C/L plane engines that were noted for their precision and power. For whatever reasons, Orwick seemed entrenched in the ignition FF and C/L era, and he showed little interest in R/C, which was fast becoming "*the* thing" in modeling. As a result, his sales slumped,

Here's another type of ground-based transmitter with a 9-foot "whip"-style antenna. I'm flying my Schmidt reeds at a Nats. Don Waite is the caller.

and Orwick eventually sold the operation to Hi Johnson in 1955.

The Orwick engines soon appeared with the Johnson label on them. As time allowed, R/C versions were offered that eventually featured the Auto-Mix carburetor.

I mentioned that Hi Johnson had experience with engines at Veco, and I assume that this helped him to further develop the Orwick-Johnson engines. In any event, subtle improvements, superior materials and adaptability to R/C needs provided us with fine engines that served us well.

The growth of R/C brought the desire for a power increase. As radios became more reliable, the sophisticated aircraft we had dreamed of became distinctly possible. The additional power that was needed equated to larger displacements, which Dynamic products didn't offer. Why they didn't follow the trend remains a mystery.

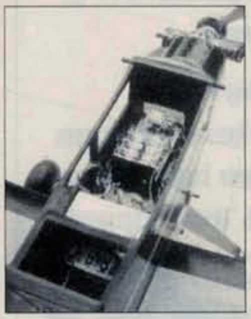
Dick tells us that Bob Holland joined Dynamic Models in about 1960. He took considerable engine knowledge and his wonderful ½A Hornet engines with him. Bob had been an engine guru for many years, and his first ½A Wasp engine was widely accepted. I believe that with the

(Continued on page 105)

ORIGIN OF MULTI-CONTROL R/C

This could be a bit repetitious, because we discussed Ed Rockwood and Alex Schneider several years ago, but it's a milestone worth repeating for new readers.

Jack Albricht of Oceanside, CA, adds to our discussion with an extensive article that covers the origin of multi-control on the West Coast. As the original Rockwood reed system concept was developed by others, the doorway to multi-control was opened to *all* R/Cers and full controls were finally possible.



This is a typical reed-system installation; note the bulk and associated weight. The receiver is forward with its reed bank, and relays are exposed. The connectors and the servos are next to it. The heavy batteries are positioned below the unit. Note the Boxer twin diesel engine that powers this German-built LW custom bipe.

Jack tells us that Ed Rockwood of Walnut Creek, CA, led the way with a comprehensive article that covered both theory and construction in the August '49 issue of *Model Airplane News.* I should add that on the East Coast, Frank Schmidt of Erie, PA, soon followed Rockwood's lead with a most successful commercial reed system.

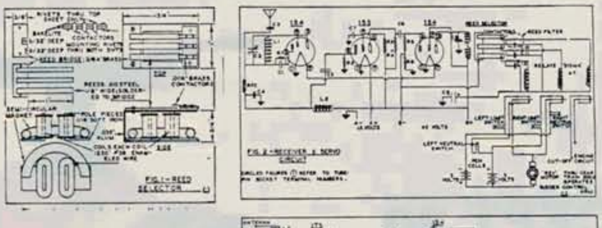
Rockwood's basic radio was simple. It consisted of a transmitter that generated specific audio frequencies that were transmitted over a 52MHz carrier and a super-regen receiver that accepted them. Unlike the usual systems of that time, in the final receiver stage, Rockwood's radio could discriminate between different audio tones and command the desired servo action. This was accomplished by what was labeled a "reed bank," which was composed of steel reeds. Each reed would only respond to one audio frequency. The reed vibrated against a low-voltage contact that energized a relay; this, in turn, supplied the required current to the servo motor. Each servo required two relays so that polarity could be switched to cause the motor and control surface to move in the desired direction. Thus there was one relay for right, a second for left and so on for each control surface. The first reed systems were labeled "5-channel" (five relays, not controls, as today), and the first multi-controls were rudder, elevator and engine. Engine carburetors had not yet arrived, so the fifth relay operated a simple, two-position servo that gave high and low speed via ignition points or a choke valve for glow.

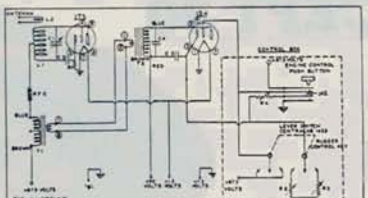
The San Francisco Mustangs R/C Club collaborated with Ed Rockwood, and they soon became an outstanding competition force in the early '50s. Led by Alex Schneider, they dominated the nats R/C events for several years.

The Rockwood system needed a heavy battery complement to ensure stability, so large models were needed to carry the weight. Various large FFs were converted, but the most popular was Capitol Model's 9-foot Cub as modified by Alex Schneider.

I was fortunate to test-fly Frank Schmidt's first reed system, so it's easy for me to appreciate the Mustangs' exuberance when they first flew a Rockwood. There just isn't a way to describe that first flight and having all the controls at your command for the first time. It was like landing on the moon.

I should say that *all* the radio manufacturers soon switched to reed systems. Orbit, Kraft and Bramco were the most popular. This advance made the average R/Cer's dreams come true; he now had the ability to fly à la full scale. R/C boomed! Only the advent of propo would add more, and with that arrival the reed's swan song was heard.





Here are the schematics of the first R/C reed system as they were revealed by Ed Rockwood in the August '49 issue of "Model Airplane News."

MODEL AIRPLANE NEWS MAGAZINE FIELD & BENCH REVIEW

BOB VIOLETT MODELS

Maverick

PHOTOS BY KENT E. LANDEFELD AND KEVIN HURDELBRINK

Ease, speed and performance

by KENT E. LANDEFELD

WHILE DECIDING WHAT my next ducted-fan project would be, simplicity was one thing that came to mind. The ducted-fan models that I had previously built and flown had been joint projects with my friend Jim Robertson, because we don't have a lot of time (or because it took *both* of us to figure it out).

I wanted a durable aircraft that I could assemble and finish in a reasonable time; one that had an easily accessible radio compartment; and one that I could fly at an array of sites. When I saw the Maverick on display at the Bob Violett Models (BVM)* booth at the '92 Toledo Show, I knew that it fit the bill. The model had all the requirements that I had been searching for in an attractive airframe.

"The only special equipment that you'll need to fly it is a starting-wand extension for your electric starter that plugs into the front of the fan."

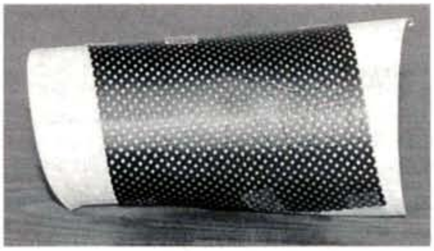
The Maverick arrived in a huge box. Thought had been put into the packaging and shipping, because the kit was packed and secured well. While unpacking it, I could see that my trips to the hobby shop would be kept to a minimum: all the parts were there, clearly marked and bagged.

A full set of auto-CAD-drawn plans, a comprehensive, 33-page construction manual, 59 construction photos (these are a tremendous help) and a decal sheet with all the necessary markings to add to the finished model were also included. As with all BVM kits, the Maverick has a lot of special "jet hardware" that's designed to make the installation of the components painless and quick. Molded, carbon-fiber-filled nylon parts such as canopy hooks, cowl keepers, hatch latches, servo trays, plug-in wing mounts, landing-gear mounts and offset door hinges are

all included. You can add a few options to the Maverick: wingtip tanks, a "hush" kit, a clear canopy and cockpit deck and flaps. I added everything except the flaps, because my field has a 400-foot asphalt runway and a long approach, so I thought that I could get by without them.

WING CONSTRUCTION

The Maverick has a carbon-fiber, plug-in wing system. The wing halves come sheeted, and are made of "molded double foam" (a combination of polystyrene and urethane foams). Molding produces a consistently straight wing panel.

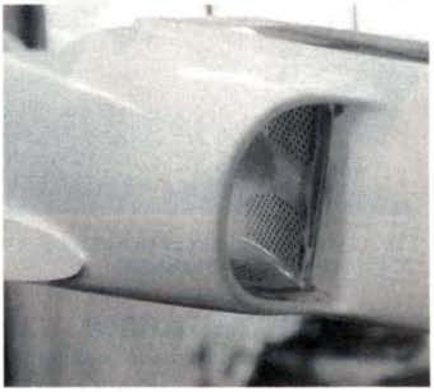


To help you drill holes in the air-inlet surfaces to install the BVM hush kit, tape this drill guide to the inside surface and then drill.

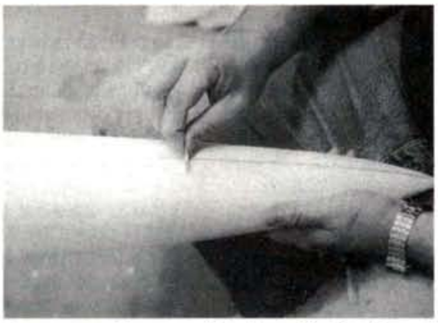
The wheel wells and servo areas were already cut out of the underside of the wing. The carbon-fiber spars, the receptacles and the dihedral braces were included in the kit. All BVM kits have carbon-fiber landing-gear mounting systems, and the Maverick is no exception. This assembly will absorb shock, and it can be easily changed if it's seriously damaged.

I began assembly by gluing on the leading edges and then sanding a slight dihedral bevel into the wing root. I lined the sides of the wheel well and the landing-gear pocket with ⅛-inch balsa before I outfitted and installed the spars and the landing-gear flex plates. This assembly ties together with three wing ribs inside the pocket. I was able to fit a Rom-Air* retract and a JR* 4131 servo into each wing panel without any difficulty.

I decided to add the wingtip tanks (BVM part no. 6505) for better flight visibility.

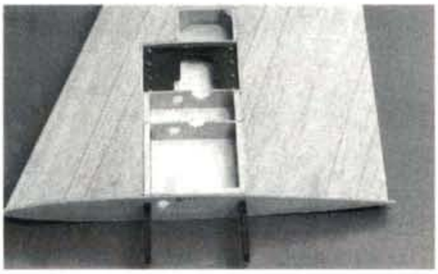


Here's the finished inlet. The hush kit has been attached, and all the holes have been drilled. The modification is said to reduce noise by 4dB.



To remove the seam line from the fuselage, I scraped the seam with a single-edge razor. This method minimizes effort and the amount of filler that's needed.

After gluing the wingtips on, I made the necessary cutouts in the foam for the wooden plugs to which the tank will be attached. (The ailerons come partially cut out, and they only require a small amount of effort to free them.) I then capped the wing notches (where the ailerons had been) with balsa sheet. I added ¼-inch-thick balsa to the aileron leading edges and then sanded and beveled the leading edge into shape. After doing the necessary sanding to each wing half, I trial-fit the hinges and ailerons. (I don't glue my control surfaces until they have been finished.) A sheet of 0.010-inch-thick Poly Ply fiberglass is provided, and I



The Maverick's wings come with the balsa skins applied and the retract bay and servo area milled out. I installed the carbon-fiber spars, the landing-gear flex-plate mount and the die-cut balsa and lite-ply parts that are shown here.

used it to cover the wing's large access hatch pocket. Using a template, I trimmed the fiberglass to size and made the necessary cutouts for the strut and wheel. The fiberglass is attached with four screws and tape (around the edges). The tail feathers are similar to the wings; they are balsa-skinned foam cores. The anhedral needed in the stab is made in the same manner at the dihedral in the wing, but be sure to sand it into the stab roots while they are upside-down.

FUSELAGE

The first step in constructing the fuselage is to remove the molded seam line and make the necessary cutouts. A tip for removing the seam instead of sanding it: draw a single-edge razor blade across the seam, and you won't have any dips in the area. (You would, if you sanded.) To ensure that the formers would stick well to it, I "scuff-sanded" the fuselage before installing them. The outside treatment of the fuselage is no exception. To make sure that no release agent was left on the white color coat, I used a Scotch Brite pad with water and Ajax.

KEEPING IT QUIET

In an effort to keep the noise level down, I added the hush kit (BVM part no. 6525). It lowers the noise by about 4 decibels. Attaching the kit to the outside of the inlets is a four- to five-hour task. In addition to the necessary installation materials, a pattern, a drill guide and drill bits are also supplied.

After I had drilled the holes, I glued a sound-absorbent foam to the sides of each inlet. I sealed it with Poly Ply fiberglass and filled the outer edges with an epoxy filler. Then I joined the inlets using the provided plywood jig. For simplicity, I chose to install a BVM mechanical nose retract (part no. 6520). I could have used a belly-mount-

SPECIFICATIONS

Type: sport ducted fan
Wingspan: 60 in.
Length: 67 in.
Weight: 14 lb.
Wing area: 700 sq. in.
Wing loading: 46.08 oz./sq. ft.
No. of channels req'd: 5 (rudder, elevator, ailerons, throttle and retracts). Flaps and in-flight mixture control are optional.
Airfoil: fully symmetrical
Wing construction: balsa-sheeted foam-core
Fuselage construction: fiberglass with color-coat finish
Washout built in: no
Engine used: BVM .91S with BVM tuned pipe
Fan unit: Viojett unit
Engine range: BVM .81-.91 or O.S. .91 with adapter
List price: $595 (at time of printing)

Features: factory-sheeted, cutout foam wings; an epoxy/glass fuselage with color-coat; fiberglass hatches and Kevlar reinforcements. The hardware package includes hinges, clevises, pushrods, threaded couplers, nuts, bolts, screws, etc. An excellent instruction manual with photos is provided. Optional clear canopy, cockpit details, wingtip tanks, a hush kit and retractable nose gear are also available. The kit comes with adapter plates for use with other manufacturers' retracts.

Hits
- Excellent radio accessibility
- Easy construction
- Forgiving flight characteristics

Misses
- None!

FLIGHT PERFORMANCE

I built the Maverick in time to attend the Northeast Texas R/C Club Jet Rally. I knew that support would be there, and that my questions regarding the Maverick would be answered before its first flight. Late Saturday afternoon, with my flying buddy Chris Huhn at my side, the Mav was ready for takeoff. The BVM .91S engine was fueled with Powermaster BVM—Special—a blended fuel that Bob Violett recommends. The wind was straight down the runway, and I had run out of excuses not to fly.

• Takeoff and landing

As with all trike-gear models, the Maverick handles well on the taxiway. I advanced the throttle slowly, and the model accelerated nicely. There aren't any torque problems with ducted-fan models, so this one stayed on the center line with only minor heading corrections. At about the 200-foot mark, I started to ease in up-elevator, and at about the 225-foot mark, the model smoothly lifted off. As I hit the retract switch, I realized that I hardly had to touch the ailerons, because the model kept its wings level as it gained altitude. No surprises at all.

The same holds true for landing; once you have established a level wing attitude, the wings stay there, and you can concentrate on the rate of descent. The Mav has a long, flat glide path, and it feels similar to a .60-size pattern ship. As I cleared the end of the runway, I applied a small amount of up-elevator and set the flare. The model didn't do anything unusual, but I kept a little throttle on until the mains touched down. Rollout is straight ahead, and I thought, "Gee, this isn't that hard—not hard at all." Keep in mind that I didn't install the optional wing flaps.

• High-speed performance

The Mav was designed for medium speeds (as jets go) of about 140 to 150mph (compared to the BVM Ultra Viper and Aggressor III that have ballistic speeds of more than 200mph). The design emphasis is on aerobatic performance. From takeoff to high-speed flight to landing, I only had to give it one "click" of down-elevator trim to fly "hands off." At full throttle, the model is very predictable, and it feels as if it's on rails. As I concentrated on making a smooth climbing turn to the left, the model was very solid, and it wasn't at all jittery. I was completely comfortable and in "jet heaven."

• Low-speed performance

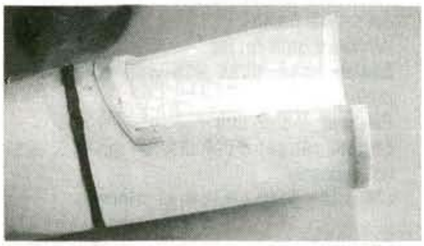
When I slowed the Mav down, I found that it still felt very solid, and only a little trim change was required. Roll control remains good, although sensitivity is slightly reduced, and pitch control requires slightly more back pressure (up-elevator) to fly straight and level. The model didn't have any bad snapping or tip-stalling problems. The design of the inlets allows the model to develop maximum thrust at any air speed or attitude. I didn't force the model into a stall configuration, because I don't think this is wise at all. Keep the model flying on the wing, and keep the nose level; nothing unusual should happen.

• Aerobatics

The Maverick has a good thrust-to-weight ratio, and it has great vertical performance. Do you want to do a vertical rolling climb? Go for it; the model will fly as high as you can see without a problem. Loops track wonderfully, and you can make the biggest ones you want without worrying that the model will fall out of the maneuver at the top. Its rolls are crisp and completely axial, and no elevator is required at all. For sustained inverted flight, I only had to hold a little down pressure on the stick, and the model flew on as if it was upright. In combining different maneuvers, such as when doing a split-S, I kept all the control imputs smooth, and the model responded likewise. I really like that the model is neutrally stable. (It goes where you point it.)

ed Spring Air* or Rhom-Air retract, but the Maverick is designed for the BVM retract, and it just falls into place.

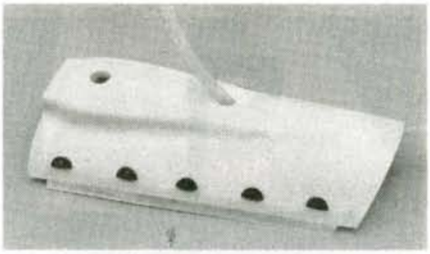
The installation of F-1 and the canopy assembly is next. The canopy is attached to the fuselage using carbon-fiber canopy hooks. The hooks are attached to the canopy in pairs; align the hooks with the



This is the forward portion of the tail-pipe duct. It has a molded lip that captures the aft edge of the Viojett fan shroud, and it has a fuelproof, color-coated interior surface. Notice the carbon-fiber band that's already glued to the outside surface. It strengthens the duct and prevents it from being deformed. I only had to install the engine-cover alignment flanges.

slots on the fuselage, and the canopy drops down and slides forward. I achieved a nice, tight fit.

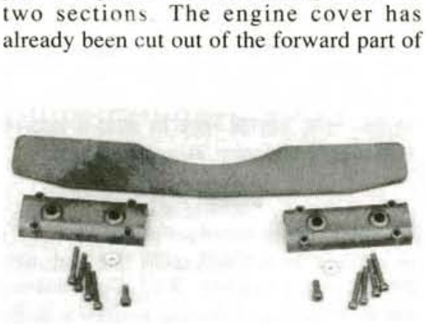
The fiberglass power section hatch was also fitted at this time. After I had trimmed it in a few areas to ensure a good fit, I installed the hatch latches and the rear alignment pin. The aircraft that I built previous to this project all had painted canopies, but I found that the Maverick's clear canopy and cockpit deck were fairly simple to install.



The sleek engine cover provides good airflow around the engine head. I only had to install the alignment flange and the molded cowl keepers.

THE POWERPLANT

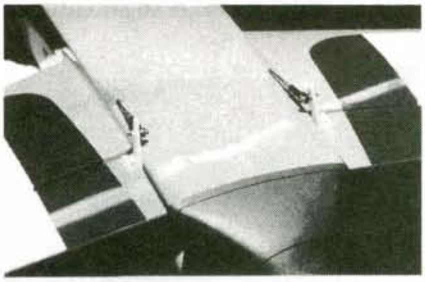
I use a Viojett* fan unit and a BVM .91S engine to power the Maverick. The installation of the fan unit is very straightforward. The fan unit is rubber mounted to reduce noise, and it's mounted on ¼-inch plywood plates. The aft ducting comes in two sections. The engine cover has already been cut out of the forward part of the aft duct. The cover is a separate unit, and it's attached to the ducting with cowl keepers. Assembling the ducting wasn't difficult, and everything fit nicely.



This wing plug-in hardware is provided in all BVM kits. The parts are made of injection-molded, carbon-fiber-filled nylon, and they're very strong.

WING AND STAB ATTACHMENT

Closely following the manual and CAD drawing that are supplied, I jigged the fuselage on a flat table and blocked the wings with the correct dihedral. I positioned the carbon-fiber spar receptacles and epoxied them into place. I attached the stabs and fin when the wings were in place. The stabs are held together with a carbon-fiber spar. This assembly makes the rear fuselage very sturdy.

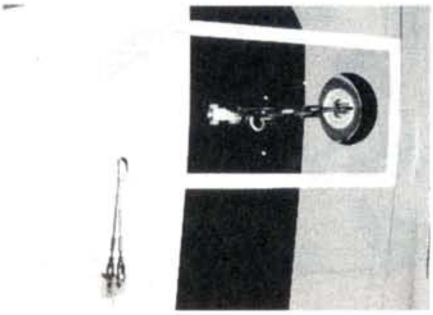


This is the Maverick's control-linkage setup. It's straightforward and uncomplicated.

RADIO INSTALLATION

As I mentioned earlier, I was looking for radio accessibility in a ducted-fan model. The removable canopy ensures that the radio gear isn't "buried"; I can check and maintain all the functions of the model.

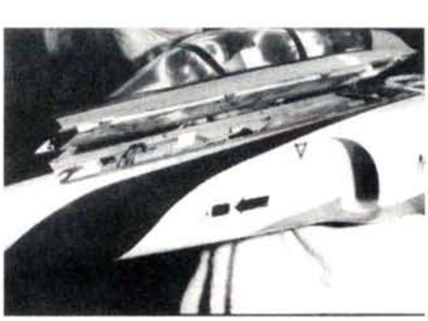
All of the trays, the mounting brackets, the cables, the pushrods and the clevises are provided. I prefer to fit the radio equipment in the fuselage and wing prior to finishing because there's less chance of damaging the model's finished surface. When positioning the forward servo tray in the Maverick's nose, use the drawings to make sure that it's placed correctly. For some reason, I mounted my tray too high. This small error caused the linkage to the mechanical nose gear to bind, and it didn't lock the retract in the down position. I have since corrected this oversight. Also, a useful list of recommended servos for each function is provided. You won't save anything by using less expensive servos; you'll only risk damaging the plane and any persons involved.



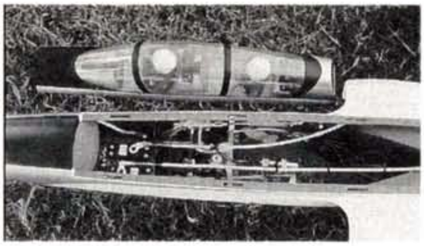
By removing this single wing hatch, you can easily access the landing gear and the aileron servo.

THE FINISH

Because the construction went so well, I wanted an exceptional finish. I covered all of the balsa surfaces with K&B* resin and cloth. Before I had applied the primer, I was approached by two club members—Bob Soukup and Frank Boardman—who introduced me to the German Spies/Hecker* paint system. I used this acrylic urethane paint from the fiberglass out. The paint is fuelproof, and it produces a gloss that can't be matched. I must thank Dennis Steffes, the president of Spies/Hecker, for his knowledge and patience. With his help, I painted and detailed the Maverick in 2½ weeks. Keep in mind that this included airbrushing and applying Aeroloft* Dry Transfer Rub-Ons, Dry-Set* Model Markings and the panel lines.



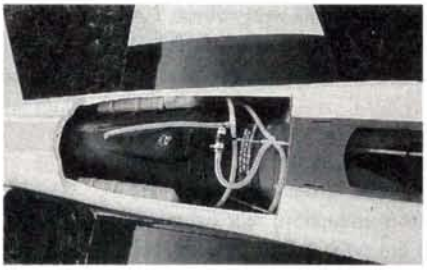
The canopy hold-down hooks slide into slots that I cut in the fuselage. Constructed properly, the system works beautifully.



The model's interior is neat and well-engineered. Shown here are (left to right) the radio-switch, throttle and in-flight mixture control servos, the top of the nose-gear retracts, the retract air valve, the wheel-brake valve, the nose-wheel steering servo and the retract-valve servo. The foam-wrapped batteries and receiver are in the nose.

SUMMARY

I wish the Maverick had been introduced a few years ago when I was a beginner in ducted-fan modeling. Although the kit is *not* inexpensive, building the Maverick instead of one of the alternatives may actually save time and money. All of its materials—from the composites to the last Allen-head cap screw—are a good value. You don't need any special abilities to assemble it properly, and everything fits together well. I really enjoyed building and finishing it. There's definitely a sense of satisfaction to see things fit together so well and then to watch it all work!



Here's the engine compartment. The engine cover is held in place with cowl keepers and O-ring loops. The remote, in-flight mixture valve is forward of the engine. Notice the twin saddle fuel tanks on the sides and the T-fittings that are used in the tank pressure lines and fuel-feed lines.

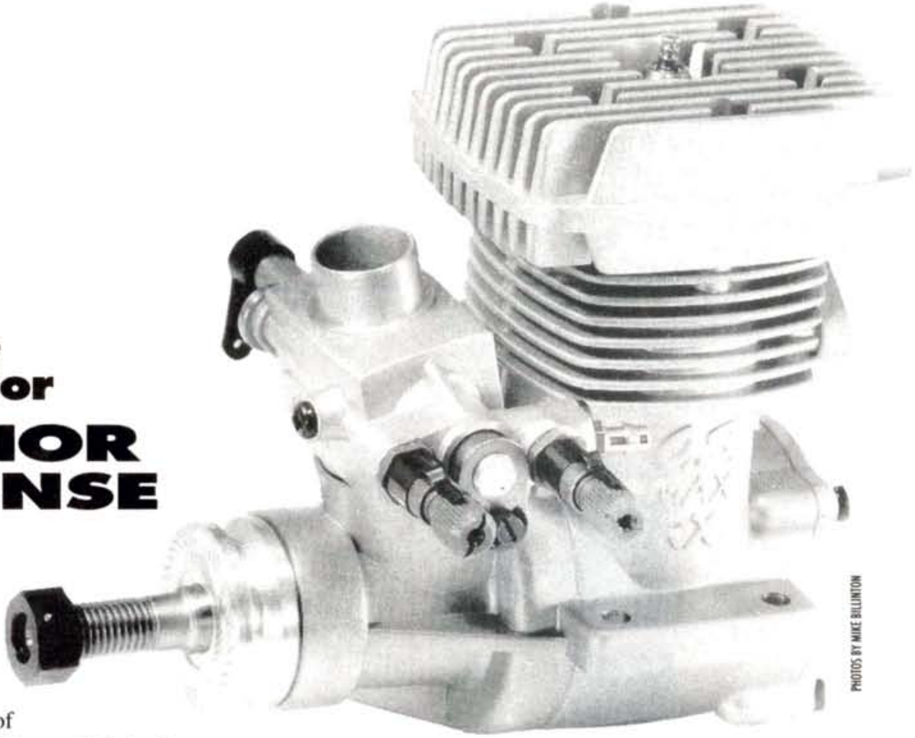
** Here are the addresses of the companies that are mentioned in this article:*
Bob Violett Models (BVM), *170 State Rd. 419, Winter Springs, FL 32708.*
Rom-Air Products, *8425 S.W. 129th Terrace, Miami, FL 33156.*
JR Remote Control; *distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.*
Spring Air Products, *82 Parkhill Blvd., West Melbourne, FL 32901.*
Viojett; *distributed by Bob Violett Models.*
K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.*
Spies Hecker Central, USA, *400 E. 23rd St., Lawrence, KS 66046.*
Aeroloft, *2940 W. Gregg Dr., Chandler, AZ 85224.*
Dry Set Markings, *10812 Bell Rock Ct., Louisville, KY 40243.* ■

ENGINE REVIEW

O.S. MAX .61 RX-H

Mid-range metering for SUPERIOR RESPONSE

by MIKE BILLINTON



PHOTOS BY MIKE BILLINTON

Solid, compact and powerful, the new Max .61 RX-H seems destined to perform well on the international F3C competition scene.

THE TASK the people at O.S. have set themselves is of "meeting the requirements of the world's leading FAI F3C competition fliers." They now produce a range of 24 helicopter engines, most of which are 10cc engines—with *18* variations! This is surely more than enough to meet the needs of heli pilots everywhere, but fierce competition leads O.S. to continue its R&D efforts—following the maxim that "To stand still is to fall behind."

With international FAI-class F3C competition fliers in mind, they've added two more models to the top of their range—the Max .61 SX-H (front-induction, side exhaust) and the RX-H (front-induction, rear exhaust), which I review here. Both are typical O.S. designs, but they have new features that required factory retooling.

CONTROVERSY?

The increasing use of non-resonant standard muffler systems with high-nitro fuels instead of tuned pipes with mild fuel has opened two areas of discussion—even controversy!

• *Power band.* Fliers want much wider, more controllable power bands than the tuned pipe usually provides, but *not all* tuned pipes are narrow-band devices. In particular, the highly regarded Hattori 650S (spiral) model has a much wider band than most—more than 2hp over a 7K bandwidth. So, in this regard, the only *real* drawback of tuned pipes is that they're generally more expensive.

• *Heat output.* Both the tuned-pipe/mild-fuel and muffler/high-nitro combinations increase power, so both increase combustion heat; but they increase power in different ways. With higher-nitro fuels, fuel flow (and fuel consumption) is greater, and this larger liquid flow through the engine enhances cooling. This is a vital difference.

Also, higher-nitro fuels allow the engine to run with what seem to be excessively rich mixtures, so an even greater cooling is available, if required.

The normal tuned-pipe/mild-fuel setups don't offer these advantages and can't easily be run at such rich settings because they might "fall off resonance."

ON THE OTHER HAND...

Saying "Nitro runs cooler" isn't a complete explanation. Whether it runs cooler will depend on the setup; it can, if it's run at richer than maximum power settings. This turns our discussion to a consideration of what's an acceptable fuel consumption.

Tuned pipes are more fuel-efficient, so fuel flow doesn't offer as much cooling. The major effect of a tuned pipe is, by resonance effects, to push the fuel mixture that has escaped through the exhaust port (and has already been heated) back into the engine. During its second journey through that port, this mixture is further heated, and this inevitably leads to hotter temperatures in the exhaust area. Also, the lower fuel consumption means that less fuel per unit of time is moving through the engine, so less heat is carried away by this means.

These points led Hattori to develop a new muffler (60HNS) for helis, and competitors say it's a more acceptable match to high-nitro fuels than most tuned pipes.

SILENCE ABOUT MUFFLERS

In the leaflet that comes with the engine, O.S. doesn't mention mufflers, tuned pipes, or the like. We may infer that they're happy to leave these matters to users. Of course, in certain quarters, this has led to the development of a dogmatic "certainty" about the way in which the basic engine should be operated!

I hope that my bare power results will help you with this, though, of course, they give no indication of how

Shown here with the new Hattori back-pressure muffler, whose large volume makes it a good match for high-nitro fuels.

different configurations can be compared with respect to heat output, flexibility of fuel-mixture controls, etc.

WHAT IT HAS

• *One-piece crankcase.* Having a one-piece crankcase occasionally leads to difficulties when assembling the piston/rod/liner unit, but many manufacturers think that its supreme advantages—rigidity and reliability under racing conditions—more than compensate for this problem.

• *Standard Schnuerle porting*—two side transfer, single boost and single exhaust. The exhaust port in the piston liner has a vertical bar that's aligned with a slot in the single piston ring. The ring is set down from the crown somewhat (it's not a dykes ring), so should it be designated ABNR.

• *High-silicon piston* with 0.0015-inch skirt clearance and 0.0035-inch crown clearance within the nickel-plated liner. The bore surface of the liner is honed before being ground to size.

• *152-degree exhaust timing*—quite low, by some standards; O.S. has probably done this so that the engine may be used with normal mufflers. (High exhaust timings—up to 180 degrees or so—restrict such engines to tuned-pipe use.) Tests revealed, however, that by also keeping transfer timing low (120 degrees), O.S. has ensured a sufficient blowdown period (15 degrees) for reasonable tuned-pipe use. A higher exhaust timing would make more power available, but the present arrangement is quite flexible and allows the engine to be set up in a variety of ways. This is perhaps why there's such a variety of opinions on how the engine should be used.

• *Short, rigid crankshaft.* This is nickel-plated before the running surfaces are ground.

• *Induction timing of 200 degrees* (consistent with current standards).

• *Carburetor bore*—10mm (consistent with current standards).

• *Crankcase bore*—11.7mm (consistent with current standards).

• *Large, one-piece, heat-sink cylinder head.*

• *New, unusual carburetor*—the 60B.

(See the sidebar for details on the last two.)

The Max .61's short, rigid crankshaft is a vital base for a high power flow, and high quality from O.S. ensures long life at those powers.

WHAT'S NEW?

THE LARGER-THAN-AVERAGE HEAT-SINK CYLINDER HEAD

Recent competitions indicate that the tuned-pipe/mild-fuel concept has fallen from favor and that there's a return to the old days of using non-resonant standard muffler systems with high-nitro fuels. Recognizing this, O.S. has therefore provided the Max 61 RX-H with a larger head-cooling area. This is a non-insert type with the combustion chamber sitting on top of liner. Weight—3.3 ounces; effective compression ratio—7.9:1 (relatively low); piston to head squish-band clearance—0.022 inch (not demanding). These last two features clearly point the engine toward high-nitro fuels.

Weighing 3.3 ounces, the large heat-sink head is fitted to cope with high-nitro fuel.

THE NEW, UNUSUAL CARBURETOR

The 60B carburetor has three fuel-mixture controls that separately affect different areas of throttle opening. The operation of the main full-throttle needle valve and a central push/pull sleeve to control idling is familiar. First, you adjust the idle control to get it reasonably correct; then you adjust the main (high-speed) needle. After that, idle might need a final fine-tuning.

Only when these two usual controls have been set properly is it correct to use the final one, which allows you to richen mid-range (or medium speed) operations, if you need to. Under normal conditions, this needle can remain closed; if, however, when hovering, you notice symptoms of lean running at mid-range rpm, you can gradually open this final needle valve until these signs disappear. Fortunately, adjusting this needle doesn't necessitate further fine-tuning of idle or full-throttle settings.

It's interesting to note the appearance of short, rigid needles in model engines. (They're almost like those in the highly reliable industrial engine carbs.) Refinements on this O.S. version include O-ring sealing, a screwdriver slot for making "at-a-distance" adjustments, and internal threads that will accept an extension bolt, if it's needed. The carb is securely attached to the crankcase by a two-piece clinch bolt (first seen on K&B engines?), and this feature rounds off a stable, reliable platform for consistently high power flows.

Its design is sophisticated, but O.S.'s new triple-control 60B carb is simple and robust. The full-throttle needle is on the right; the new mid-range needle stands vertical to the left. In the middle is the idle-control "plunger" that operates by moving axially along the barrel's center line to reduce fuel as the throttle is closed. It's controlled by turning a screw that's in the carb body just below the central opening.

The instructions for tuning/adjusting this carb come on a comprehensive chart, which, at first sight, might lead you to think that it's a very complicated device. In practice, it proved to be very easy to adjust (on the dyno, at least), and it was clearly designed to be mechanically solid and foolproof in competition.

Finally, unusual care has been taken to insulate the carb from crankcase heat with an insulating sleeve and an O-ring. This means steadier settings and probably slightly increased power (because it makes the fuel/air mixture going to the engine denser).

SPECIFICATIONS

WEIGHTS & DIMENSIONS

Capacity	0.60576 cu. in. (9.9266cc)
Bore	0.944 in. (23.97mm)
Stroke	0.8655 in. (21.98mm)
Stroke/bore ratio	0.917:1
Timing periods	Exhaust—152°
	Transfer—120° (angled up 15°)
	Boost—110° (angled up 60°)
	Front induction—Opens 34° BTDC
	—Closes 54° ATDC
	—Total period 200°
	—Blowdown 15°
Combustion volume	1cc
Compression ratio	Geometric —10.93:1
	Effective —7.9:1
Exhaust-port height	0.264 in. (6.72mm)
Cylinder-head squish	0.022 in. (0.56mm)
Cylinder-head squish angle	5°
Squish-band width	0.171 in. (4.36mm)
Carburetor bore	0 .393 in. (10mm)
Crankshaft diameter	0.669 in. (17.01mm)
Crankshaft bore	0.460 in. (11.7mm)
Crankpin diameter	0.275 in. (7.0)
Crankshaft nose thread	0.310 x 24 TPI (5/16 UNF)
Wristpin diameter	0.236 in (6mm)
Connecting-rod centres	37mm
Engine height	3.966 in. (100.7mm)
Width	2.405 in. (61.1mm)
Length	3.54 in. (90.0mm)
Width between bearers	1.685 in. (42.8mm)
Mounting-hole dimensions	2.047x0.984 in. (52x25x4.2mm holes)
Ex. manifold bolt spacing	1.18 in. (3mm)
Frontal area	7.6 sq. in.
Weight	Bare —21 oz. (596g.)
	—with Hattori muffler —24.9 oz. (706g.)
	—with Hattori tuned pipe —27.3 oz. (776g.)
Crankshaft weight	3.60 oz. (103g.)
Piston weight	0.30 oz. (9g.)

Performance:	2.46 @ 14,326rpm (Hattori tuned pipe/30% nitro)
Max. b.hp	2.38 @ 17,785rpm (open exhaust/5% nitro)
	2.31 @ 13,990rpm (Hattori tuned pipe/5% nitro)
	2.14 @ 17,738rpm (Hattori muffler/30% nitro)
Max. torque	178 oz. in. @ 12,733rpm (Hattori tuned pipe/30% nitro)
	165 oz. in. @ 12,220rpm (Hattori tuned pipe/5% nitro)
	154 oz. in. @ 11,608rpm (open exhaust/5% nitro)
	140 oz. in. @ 11,620rpm (Hattori muffler/30% nitro)

RPM on standard fixed-wing propellers

	Open-ex. /5% n.	Hattori t. pipe/30% n.	Hattori muffler/30% n.	Hattori t. pipe/30% n.
MK 13x10.5	8,367	7,852	8,229	8,507
Top Flite 13x6	11,460	—	11,822	—
MK 13x6	11,554	12,018	—	12,701
Graupner 12x6	13,334	13,810	13,224	14,171
Graupner 11x6	14,770	15,270	14,854	15,558
MK 10x6	16,188	16,070	16,001	16,324
APC 10x6	17,387	17,300	17,434	17,460

Performance equivalents

	Open-ex.	Hattori muffler/30% n.	Hattori t. pipe/5% n.	Hattori t. pipe/30% n.
B.hp/cu. in.	3.93	3.53	3.81	4.06
B.hp/cc	0.24	0.21 5	0.23	0.248
B.hp/lb.	1.81	1.37	1.36	1.45
B.hp/kilo	3.99	3.03	2.97	3.17
Oz.in./cu. in.	254.20	231.00	272.40	293.80
Oz.in./cc	15.50	14.10	16.60	17.90
Oz.in./lb.	117.30	89.70	97.00	104.70
Newton meter/cc	0.11	0.10	0.118	0.128
B.hp/sq. in. frontal area	0.31	0.28	0.30	0.324

Manufacturer: O.S. Engines, Osaka, Japan.
USA distributor: Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

POWER TESTS

Using fixed-wing propellers, I did the necessary small amount of running-in. Several standard rpm checks showed that the .61 RX-H is, in open-exhaust form, anyway, a superior performer.

• **Test 1. Open exhaust**. Fuel—5 percent nitro, 12 percent ML70 and 6 percent castor oil.

Early signs of the engine's potential came with some high torque values, maximizing at 154oz.-in. at 11,608rpm. These are the highest figures I've ever recorded for a 10cc engine in this configuration. Likewise, maximum horsepower was also greater than previous "best values," with 2.38b.hp at 17,785rpm. These figures all suggest that O.S. engineers have done considerable development work.

• **Test 2. Hattori 650S (spiral) tuned pipe.** Fuel—5 percent nitro.

I recently used this "wide-band" tuned pipe when testing the Rossi R60 heli engine; it was flexible and gave reasonable maximum power.

Here, the O.S./Hattori combination showed an even wider, flatter response, as well as higher maximum torque and horsepower. Again, the pipe's convoluted metal header was highly useful; it offers a fast, practical attachment method, and unlike some other tuned-pipe fixings, it's unlikely to deteriorate with time. That the pipe may be fixed at a variety of angles is a considerable bonus.

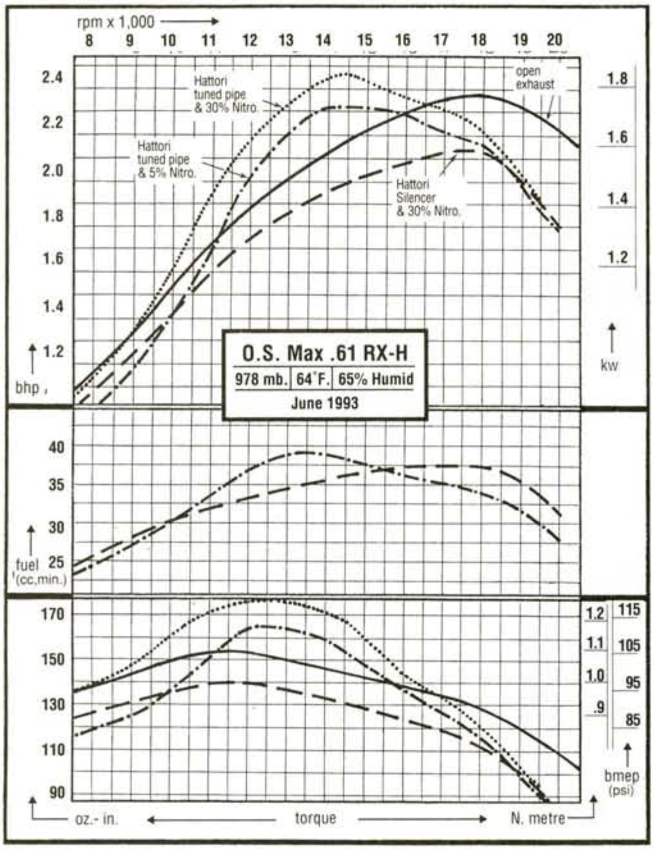
At this stage, the needle-valve range that gave correct mixture strength was quite narrow—because the needle taper was too coarse, because quite small adjustments noticeably changed rpm, or because the range of fuel mixtures that gave correct combustion was narrower than average. The situation was, however, controllable, and correct settings and smooth power flow can be guaranteed.

• **Test 3. Hattori muffler.** Fuel—30 percent nitro.

I hear that, for the most part, this new back-pressure muffler (type 671-60HNS) is used mainly with higher percentages of nitro-methane. This combination reduces noise; it has an appreciably smoother power curve than the "roller coaster" that's typical of the usual tuned pipe (in effect, it duplicates the wide-ranging characteristics of the open-exhaust curve), and it simultaneously reduces the power loss that's inherent in the use of this type of muffler (approximately 90 percent of the open-exhaust power is retained). This increases operational flexibility and gives a power curve that's more in keeping with a helicopter's requirements.

With the Hattori muffler fitted, the engine operates at a typical full throttle 17,000rpm (for a head speed of 1,700rpm); reducing rpm to 13,000rpm for hovering sees lower horsepower, and that's what's required for general heli use.

Using a tuned pipe leads to a very different situation: operation at 17,000rpm



"past the peak" on this Hattori fixed-length pipe gives adequate power for major maneuvers, but reducing rpm for hovering leads to a large rise in horsepower. This increase has to be "dumped" by an appreciable closure of the throttle, and that leads to a less than "linearly smooth" transition—most important for heli use. Any attempt to bring the maximum resonance point nearer to 17,000rpm by changing pipe length risks incurring a "fall off the back end" of the resonance curve when attempting to hover at around 13,000rpm.

The Hattori pipe's response range is wide enough to give a reasonable result when operating the engine "past the peak" condition shown in this test, but it isn't as good as that traditionally smooth, very wide, open-exhaust power curve. It seems that developments in the F3C operating schedules have taken the rpm range requirement marginally beyond even the widest tuned-pipe power bands (a pity because, at one time, the helicopter seemed to be an almost fixed-rpm device).

It's also significant that I noted a marked increase in the flexibility of the fuel controls and the throttle movements when using a high-nitro fuel. As mentioned earlier, an unusual characteristic of high-nitro fuel is that it allows the engine to operate at excessively rich fuel settings without quitting. This characteristic "desensitizes" the normal needle-valve fuel control and almost guarantees continual, successful engine operation. It also offers beneficial extra cooling—although at some increase in fuel consumption.

• **Test 4. Hattori tuned pipe.** Fuel—30 percent nitro.

In view of the extra stress to which it would probably subject the engine, I ran this test last, but the .61 RX-H sailed through it without a problem. The test figures confirmed that using a higher percentage of nitro boosts torque production, but this effect diminishes as rpm rise. I also confirmed, yet again, the Hattori tuned pipe's wide-band performance.

With 30-percent-nitro fuel, horsepower was increased to 2.46 at 14,326rpm—useful, but not as much of an increase as might be expected.

My tests comprised 95 individual runs using just one OPS 250 "thick"-element plug (it survived). This is a reflection of the engine's "undemanding" squish-band clearance and compression ratio, but the robustness of the glow-plug also offers considerable long-term reliability.

IDLING

Using the muffler, tank-pressure feed, 12x6 propeller and 30-percent-nitro fuel allowed easy low-speed rpm of 1,900. This represents a setup with higher inertia than the average heli flywheel, so a more realistic idle is around 2,200rpm. Having set the carb's three controls—a two-minute task—throttle response was reliable, steady and very swift, even after fairly lengthy idling.

SUMMARY

In the coming months, it will be interesting to monitor the international FAI F3C helicopter competition results to see whether O.S. has achieved its goal of meeting the requirements of the top competition fliers.

My dyno tests give some indication of this fine engine's potential, and it goes without saying that its design, construction and finish are of exemplary quality. ■

SIMPLE PROGRAMMING

DAVID C. BARON

A LOOK AT FUTABA'S 9ZAPS

The new Futaba 9ZAPS is the ultimate example of a programmable radio, and it offers synthesized frequency selection.

THIS COLUMN completes the review of the Futaba* 9ZAPS that I started as a sidebar in the last issue. This radio has so many capabilities that I can't cover them all in detail in the space allowed. I will, however, cover items that are common to all models—whether airplane, helicopter, or glider—and leave the specifics of each type for you to discover.

There are three main programming sections on the 9ZAP: the system menu, the model-setting section and the condition section. Each of these offers unique applications for each type of model; this is because the 9ZAP is a fully functional helicopter, glider and airplane radio.

• **System menu.** This level contains all the radio's controls and capabilities, and, therefore, it affects all the models in the radio's memory.

• **Model-setting section.** This section controls variables that aren't likely to be changed very often, e.g., model name, servo-reversing, PCM or PPM selection, etc.

• **Condition section.** This area controls condition variables that you want to change on a given aircraft, such as the amount of elevator throw for different maneuvers, or the preprogrammed configuration mixes for landings, takeoffs, spins, etc. Conditions include variables that you want to vary, or features that you want to manipulate in flight with the flip of a switch.

The best way to describe the scope of the FP9ZAP's capabilities and the depth of its programmability is to summarize its features under the three main programming sections. This is only the tip of the iceberg, but a perusal of this summary will give you a good idea of the radio's amazing capabilities.

The radio transmitter is compatible with all Futaba PCM 1024 receivers and 1991 FM receivers, and it can be used with almost any system that you already have. Here are the FP-R129DP receiver and one of the S9101 servos that comes with the 9ZAP.

THE SYSTEM MENU

MSL. Model select offers the user access to the different model memories stored in the transmitter and in the optional memory module (CAMPac). Up to 10 models can be stored in the basic configuration, and 16 additional memories can be stored by using the CAMPac.

VLT. This is an expanded scale voltmeter for the transmitter and receiver Ni-Cds. To test the receiver pack, the DSC cord must link the transmitter to the receiver. The load is switchable between 250mA and 500mA.

TAC. The tachometer function can measure any propeller with one to five blades up to 50,000rpm.

SRV. This is the servo cycle and bar graph display. The servo cycler exercises your servos through their maximum limit. This is valuable for checking servo potentiometers and gears for damage and to make sure that there's nothing binding in your control surfaces or control installation.

The bar graph shows positive and negative servo deflection in relation to neutral and max deflection. For example, you can verify that your aileron (flaperon) servos are set precisely at neutral so that a servo on one side of the wing doesn't have more up (or down) deflection than a servo on the other side.

TRN. The trainer system allows the instructor to dictate which channels the student can command. A mixing feature allows the instructor to make corrections without taking control away from the student. This creates a situation in which both transmitters' controls are active. This system would be very helpful in helicopter training, in which there is little time between making errors and hitting the ground!

DTN. The data-transfer function is used to exchange data between two

9ZAP transmitters. A trainer cord is necessary to join them.

CPM. The copy program offers a low-risk way to modify the programming of a model that has already been set up. Simply copy that memory to an open or unused position, and make all the changes you want. You can always return to the original setup, if necessary.

The transmitter layout is comfortable to handle, and the big display screen is easy to read. The radio is so flexible that any function or channel can be assigned to any stick or switch. Gaining access to the main menu is very easy.

CPC. This function allows you to copy individual conditions for reuse. The condition can be as simple as a dual-rate switch setting or as complex as a formula for a helicopter's switchless inverted flight.

PAR. The parameters function automatically switches off the transmitter if it's left inactive for a given period. It has a range of 10 to 40 minutes. This function can also be used to adjust the contrast controls for the screen.

UNA. User name registration is the section in which you can set the transmitter to display your name whenever the main screen is illuminated. This is protected by a password or code. The 9ZAP is also capable of locking out all access to your model memory and system sections. This is also protected by a password or code.

FRQ. If you own the 9ZAPS *synthesized* radio, then you have access to the frequency-synthesizing feature. It allows you to use your radio on any channel from 11 to 60. The greatest value here is that you can use the versatile 9ZAP transmitter with any '91 Futaba FM or PCM receiver that you already have! If you own a few Futaba radios, this may be the greatest single reason to spend the extra money on the synthesized version of this radio.

SWT. This function is available in several different areas and isn't part of the system per se. Switch assignment is a wonderful feature that enables you to tailor your radio's switches and sticks to meet your specific needs. The more you think about it, the more interest-ing the feature becomes. Any switch can be assigned to any channel or function, and any stick can be assigned to any channel!

MODEL-SETTING SECTION

CSL. Condition select involves the cataloguing of a variety of flight conditions that you create. Conditions have names and can be bunched in groups of four.

TIM. The FP9ZAP has two built-in timers and an elapsed-time counter. They can be reset and triggered to start and stop by most of the switches and even by the control sticks.

F/S. Fail safe should be common to us all by now. The radio can be set to go to a preset position in case of interference, or to remember the last command it received and hold that setting until it receives another signal. The radio also has a throttle warning feature that alerts you to impending airborne battery failure.

PMD. This function allows you to switch between PCM and PPM pulse modulation.

REV. This is the servo-reversing function.

FNC. Function control allows you to change the transmitter switch that generates a signal from a given channel. For example, you may choose to have your flaps actuated by a lever on the side of the transmitter instead of using the knob on the face of the transmitter.

RST. This allows you to reset partial settings or the entire model memory. Options include reversing and fail-safe, AFR and dual rate, trim, ATV, SMIX, PMIX, COND and ALL.

CUT. This is a built-in engine-cut switch. I find it very useful because of the non-traditional trims used in the 9ZAP. The engine-cut feature will be actuated only when the throttle is below a preset setting.

CHD. Condition hold is, in effect, a temporary throttle hold that you can use to modify your radio's programming while the engine is running. Obviously, this would have real value in a helicopter.

TYP. Type selection allows you to choose between airplane, glider, or helicopter programming. Always switch to an open model memory when you change from one type to another.

CH9. The ninth channel of the 9ZAP is used for switch selection and direction.

MNA. Using model name, you can assign an eight-character name to each model in memory. Whenever you select a model from memory, its name appears in the top center of the display screen.

ALT. The alternate switch allows the spring-loaded switch to work in two

(Continued on page 110)

Mike Gross puts his Supermarine Spitfire Mk 4 into a low, high-speed, knife-edge pass. The model is a dolled-up Jim Meister, giant, fun-scale design powered by a Quadra 35, and it has Robin-Aire retracts.

6th Annual Giant Warbi

by GERRY YARRISH

On a slow flyby, Mac Smith's UC-87 Bamboo Bomber showed great handling characteristics. Two Super Tigre .90s powered the SuperCoverite-covered, 97-inch-wingspan model.

THE SKY IS gray with a threatening, low-hanging thunderstorm to the east. On final, there's a four-engine, Avro Lancaster bomber. As the behemoth touches down, two Hawker Hurricanes flash by, making ready for their entry into the pattern.

Lined up next to the runway are B-25s, a C-47, a Spitfire and two P-47 Thunderbolts. Is this some forgotten aerodrome in WW II England? No! It's the Sixth Annual Giant Scale Warbird Festival. Though the '93 Festival was threatened by impressive thunder and lightning, the ceiling improved, the thunderheads departed, and the roar of large gas engines provided their own type of thunder.

Nick Ziroli Sr.'s P-61 Black Widow night fighter was very impressive. On many occasions, Nick had the Widow down on the deck at full power.

THE MUSEUM CONNECTION

Sponsored by Miniature Warbirds Ltd. and hosted by the Empire State Airshow Team, the Warbird Festival now has its permanent home in Schenectady, NY, and its organizers work hand in hand with the Empire State Aerosciences Museum.

Established through the hard work of Roy Vaillancourt, Ron Chizek and Don Whittacre, the site boasts an 80x800-foot sod runway. It's close to the active county airport runway, so the Festival had its own air-traffic controller, who was in constant contact with the airport tower.

The warbirds generate a lot of interest, so they draw many visitors to the small, but growing, museum. This year's event raised approximately $7,000 for the museum, so it's a win/win situation for the museum, Miniature Warbirds and the community.

(Continued on page 79)

This big P-40 Warhawk was built by Joe Wcela of Bohemia, NY, from Ziroli plans. Powered by a Quadra 50, the plane has Robart 90-degree retracts.

PHOTOS BY GERRY YARRISH

Aviation history and miniature WW II classics live in Schenectady, NY

rd Festival

One of the fastest fighters, this Grumman F6F-5 was built by Tony Kirchenko of Long Island, NY, from a Byron kit. Powered by a Sachs 4.2 turning a three-blade 24x18 prop, the 29-pound model has a 91-inch wingspan, Robart retracts and Byron wheels. The finish is lacquer, and the paint scheme is that of VF-24 that was stationed aboard CVE-29 USS Santee in July 1945.

Official flag bearer Mike Whittacre seems to symbolize the Giant Scale Warbird Festival. Pride, dedication and patriotism were evident throughout the weekend.

The shiniest example of a Ziroli SNJ-5 Texan was this beauty built by Jerry Biolass of New Hampton, NY. Powered by a Super Tigre 4500, the model was finished with chrome MonoKote over silkspan-covered balsa. Each panel was applied individually, and the "button-head rivets" were made with 30-minute epoxy mixed with aluminum powder and dotted on with a toothpick.

Ron Chizek starts the engines on his Douglass C-47 while Myron Eister steadies it. Unfortunately, an engine out did the model in on the last day.

Two big P-47 Thunderbolts sit on the line during the intermission. The one in the foreground is the work of Dick Ewald of Averill Park, NY. Powered by a Zenoah G-62, it has flaps and Hank Likes retracts. The other is by Mike Gross of Long Island, NY. It has G-62 power and Robart retracts. (Both are Vailly Aviation semi-kits.)

The spectators were allowed onto the flight line and runway to take photos and talk to the pilots. Here, Wayne Bransfield's Avro Lancaster bomber and Mac Smith's deHavilland Mosquito are center stage (both great fliers).

MEASURING UP

It's an IMAA event, so all models must comply with the organization's safety guidelines and size requirements. Each model is inspected before it flies, and features such as battery size, engine setup and operation, and general construction methods are checked. After inspection, the fun begins and pilots get down to some serious flying. Having fun is their prime directive, and there are no trophies to win or contest worries.

GETTING IN THE MOOD

The only requirement is that participants fly warbirds that date from 1935 to 1950. Roy ("Douglas McArthur") Vaillancourt runs the event much like the director of a 1940s war movie—right out of Hollywood! The wearing of WW II clothes is encouraged, and many participants show up in olive drab and khaki duty uniforms, complete with brown boots, straps and rank insignia.

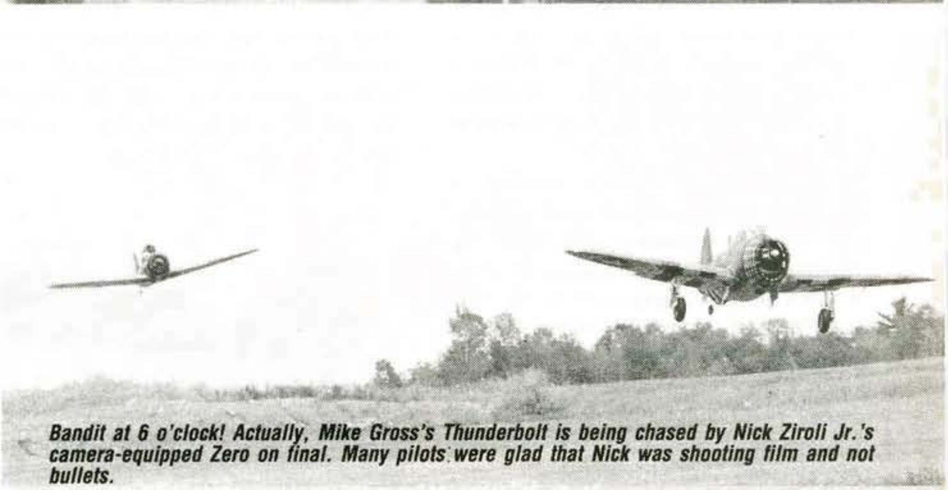
Every day, at 0800 hours, reveille is played as the Stars and Stripes are hoisted. Assembly follows at 0900, and every day ends at sunset with taps. You go to the "radio room" to have your transmitter impounded; there's an "induction center" where you can join the Miniature Warbirds Ltd. organization; you can buy pins, shirts and hats at the Warbirds "PX"; and, of course, food is served in the "mess tent."

To honor the many Canadian modelers who made their way to the Festival, the Canadian anthem was played after the U.S.'s every day. And as a final touch of class, official flag bearer Mike Whittacre, dressed in his grandfather's WW II uniform, "presented the colors" to start each day's flying.

FLIGHT-LINE CENTER

Everyone comes to see the models and the pilots who fly them, and there was a lot to look at this year. Though slightly fewer fliers than usual showed up, the caliber of the participants more than made up for the slight reduction in numbers.

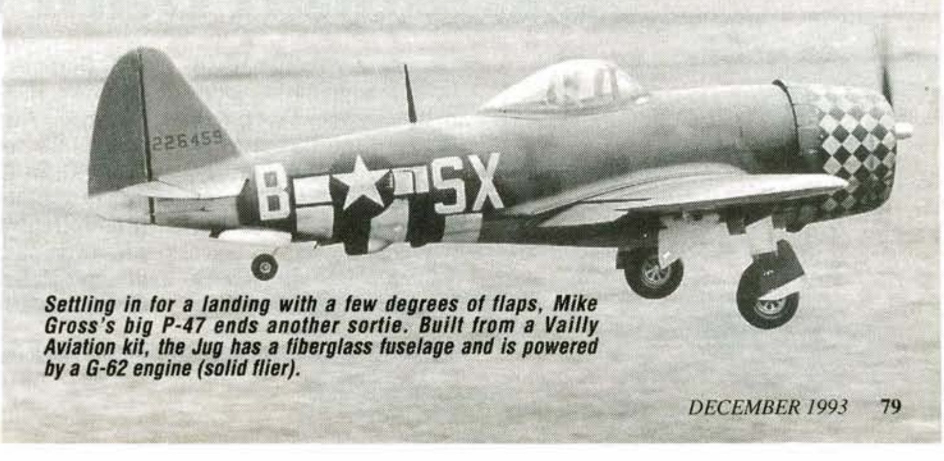
Flight-line center. This is what it looks like from the pilots' box. In the air are an AT-6 Texan, a Junkers Ju 87 Stuka and a camcorder-equipped Japanese Zero.



Bandit at 6 o'clock! Actually, Mike Gross's Thunderbolt is being chased by Nick Ziroli Jr.'s camera-equipped Zero on final. Many pilots were glad that Nick was shooting film and not bullets.

This full-size 1944 vintage P-51D Mustang dropped in for a visit and was a big hit with all the spectators and pilots. Flown by Charlie Mothon, the Mustang flew four, high-speed, low-level passes over the field.

With some top rudder, Chris Desain's P-51D—Chrips-A-Mighty 3—enters a knife-edge pass. This warbird looks great and is a great flier.



Settling in for a landing with a few degrees of flaps, Mike Gross's big P-47 ends another sortie. Built from a Vailly Aviation kit, the Jug has a fiberglass fuselage and is powered by a G-62 engine (solid flier).

Bill Steffes (with radio) helps dial in line boss Sal Savarese's Stearman PT-17 bipe. Sal coordinated the flight-line activities and did a great job of making sure that safety was everyone's priority.

There was hardly a moment when some piece of military history wasn't carving up the sky or making a strafing run on an unseen miniature enemy. This seemed to be the year of the multi-engine model, and the sound of sync'd engines was always there. There were two B-25s, a C-47, a British Mosquito, a UC-78 Bamboo Bomber, an unfinished Me 110 and an impressive, four-engine, Avro Lancaster bomber.

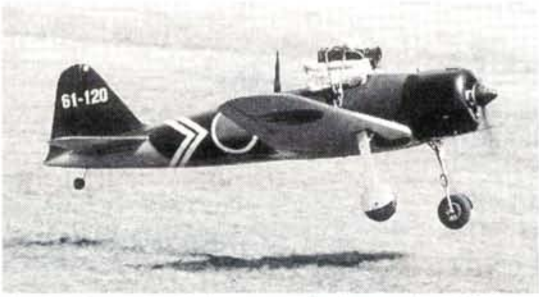
With so many heavies needing an escort, the fighter jocks had ample opportunity to fly in formation with their "big friends." If anything was missing this year, it was German fighters, such as Me 109s and FW 190s for the allied fighters to mix it up with. Two examples of the German war machines that threatened the field were Junker Ju 87 Stuka dive bombers. John Niezelski of Beacon Falls, CT, and Nick Ziroli Sr. were the Luftwaffe pilots.

FIGHTERS OF THE SOUTH PACIFIC

The South Pacific theater was well-represented, and there were plenty of Japanese Zeros to chase and be chased by. Of particular note was Nick Ziroli Jr. (Top Gun Best Military Winner), who flew a very special Zero. This "Rising Sun" fighter not only chased the other fighters in the 6-o'clock slot, but it was also equipped with a camcorder to capture the combat on tape! This was later played back for the enjoyment of the combatants.

On the U.S. side, Corsairs, B-25s and a P-40 kept the action going in true "Tora, Tora, Tora!" fashion. Paul Offermann of Moneta, VA, had a great-looking, glass-nose B-25, while John Lewis of Warwick, NY, had a solid-nose, gun-ship version of the Mitchell medium bomber. Both were scratch-built from Ziroli plans, and both had operating bomb bays.

Joe Wcela of Bohemia, NY, brought along a Ziroli-designed P-40 done up in desert camouflage. The big Warhawk was powered by a Quadra 50 and flew in a very scale-like manner. You could almost smell the salty sea air as these "war-torn" aircraft flew by.



Just about to touch down—a pilot's-eye view! Nick Jr. chased the Yankee dogs all afternoon.

As with all contests, there was a downside—some casualties of war. Three were F4U Corsairs, and the last to succumb was a C-47. Ron Chizek's popular Gooney Bird went in because it lost an engine and accidentally turned into the dead engine, and the three bent-wing birds died because of various mechanical problems. None of the incidents was attributed to radio interference, and all the planes are repairable and should return next year.

Nick Ziroli Sr. campaigned his impressive P-61 Black Widow, and he would have been awarded the Lowest Pass award. The all-black, 114-inch-wingspan model performed flawlessly, and if it had extended its landing gear, it could have plowed rows for corn! This, along with the smoothness of Nick's control, had me voting mentally for it as the most impressive twin *on* and over the field.

ON THE EUROPEAN FRONT

During the weekend, dogfights from the skies over war-torn Germany, France, England and Russia were also in style, and many of the classics flew. No less than four Hawker Hurricanes (one in Soviet winter colors) were on station. During one organized effort with a Supermarine Spitfire, two of them closed up formation with the "giant of the giants gathering": Canadian Wayne Bransfield's Avro Lancaster "Dam Buster" bomber. The sight and sound of the group was magical and seemed all too real.

Then, on another sortie, the Lancaster and a deHavilland Mosquito shared the pattern for low-level bombing and strafing runs. One could almost hear the machine guns and exploding shells as the two gladiators of the clouds thundered by.

From Midway Island to the Russian front, just about every piece of aviation hardware was represented—sorta like a miniature version of the TV show "Wings"! But *this* version was up close and real!

FULL-SIZE IRON

In keeping with Giant Warbird Festival tradition, the loudspeaker boomed out the message that a full-size warbird was sighted and was about to do a high-speed, low-level run. As the flight line was cleared and

Canadian Dam Buster

It was a great surprise to see such a large model at this year's Warbirds Festival, and everyone appreciated the work of Wayne Bransfield of Burlington, Ontario, Canada.

Spanning more than 13 feet and powered by four O.S. Surpass .70 4-stroke engines, the monstrous, 1/8-scale, Avro Lancaster weighs 38 pounds and is more than 9 feet long. Because of its sheer size, the model has flaps but no retracts, but this doesn't detract from the model at all. The wing is a two-piece affair that's joined in the middle by an extruded-aluminum spar. It's bolted to the fuselage in the traditional way, but the fuselage is unique in that it, too, is made of two parts: about 12 inches aft of the wing's trailing edge, the tail can be sepa-

This is what Wayne sees when the bomber is on final. The model flew up a storm during the Festival.

Empire State Aerosciences Museum

A peek inside the Empire State Aerosciences Museum, where there are many full-size exhibits and beautifully detailed models and dioramas.

The museum is on the site of an old General Electric test facility. During WW II, one of the first successful jet engines was test-run there, and developments made there led to the design of the J-47, J-73 and J-79 engines.

Other aviation "footnotes" are the development of the B-17's supercharger. The B-29's fire-control systems were developed on the site, and the first jet airmail service was started here with a specially outfitted F-80 Shooting Star.

The facility was also witness to the first Stealth technology experiments in which the U.S. government studied the feasibility of reducing aircraft radar signatures by reducing the amount of metal in an airframe. The first aircraft to be tested was the Lockheed Gama Racer, in which fiberglass fuel tanks replaced the metal ones.

The contributions of the people of Schenectady and nearby Scotia to the war effort and to general aviation are many, and it's fitting that this growing museum is preserving this information for the generations to come.

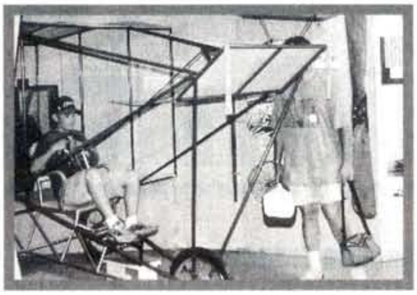
The museum displays some very interesting aircraft. In the back are older, more well-used exhibit pieces, including a Phantom F-4 jet, a WW II C-47, the yet-to-be-restored bare bones of a Bell P-39 Airacobra and an air worthy MiG 17!

The MiG was given to the museum by the Polish Air Force shortly after the fall of the Soviet Union—crated right after a training mission. When U.S. customs officials opened the crate, they found that there was still fuel in the tanks and fuel lines and still *hundreds* of rounds of live ammunition in the wings! Left in the cockpit were a well-used, but complete, flight-training manual as well as service manuals, maps and navigation equipment—a complete package indeed.

The museum's only problem is finding someone who can read Polish so that they can completely understand the requirements for returning their MiG to a 100-percent flight-ready condition.

With all the hard work of volunteers such as Charley Wood and Ernie Tetrault and the coordination efforts of museum vice president Dan Whiteman and the Giant Warbirds Festival committee, I'm sure the museum can look forward to continued support and development.

When you go to see the Miniature Warbirds, stop by the Empire State Aerosciences Museum and drop a dollar or two in the bin. You'll be helping to preserve a piece of aviation history.


In the vintage aircraft section, a young aviator wannabe tries out the controls of a Curtiss Wright flier mockup. In the museum, there are many hands-on displays for the young and the young at heart to try out.

all the FAA safety requirements were fulfilled, a big, beautiful 1944-vintage P-51D Mustang flashed by for not just one but four low-level, goose-bump-inducing passes.

After the last pass, the Mustang entered the landing pattern, taxied to the ramp just in front of the museum and then parked. Pilot Charlie Muthon answered questions and offered spectators the chance to see his famous fighter up close and personal.

This was a real treat for anyone who's even *casually* interested in aviation or history. It was a perfect icon on which to focus this mixing of miniature model warbirds and the rich aviation history of the Schenectady County Airport. You'll find this event hard to beat, and it certainly should be on your '94 calendar.

Many people worked hard to bring the level of professionalism displayed at the Giant Warbirds Festival to such a high level. Everyone involved in the event deserves a pat on the back. I also thank line boss and safety coordinator Sal Savarese for working closely with me and allowing me the extra freedom to move about the pits and on the runway while I photographed all these wonderful warbirds.

Next year's Giant Warbird Festival will be at Schenectady County Airport, Schenectady, NY, on July 22 and 23. Prepare your model, put on your fatigues and head for a nostalgic weekend of military history—a weekend of warbirds. ■

rated from the fuselage by removing a few screws. It still takes a *big* van to move this bit of British aviation!

The model is made of balsa and plywood and is finished with Sig Koverall and Perfect Paints to replicate the colors of an RAF night-bomber squadron. There are 14 servos aboard, and Wayne uses a Futaba 1024 radio for control.

Each engine has its own fuel tank and throttle servo, and the four servos are slaved together on one channel. The engines turn Graupner 11x7, three-blade props. Wayne has been flying the model for three years and has logged more than 76 flights. Flown in formation with many other models during the festival, the Lancaster proved to be an honest, predictable flier.


The giant of the Giant Warbirds Festival, this Avro Lancaster bomber is the work of Canadian Wayne Bransfield. It has a 13-foot wingspan and is powered by four O.S. Surpass .70 4-strokes.

HOW TO

Horizontal Tail Design

by ANDY LENNON

PART 2

How placement and size affect stability and balance

Editor's note: in Part 1 of this series, the horizontal axis at the bottom of Figure 5 lacked a caption; it should have been labeled: "Wing drag coefficient." The upper and lower charts in this figure compared the effect of aspect ratio on wing lift coefficient across a range of angles of attack (top chart) and wing drag coefficients (bottom chart). We regret any inconvenience caused by this omission.

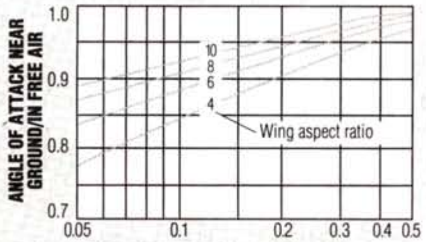


FIGURE 6. ***Impact of ground effect on angle of attack.***

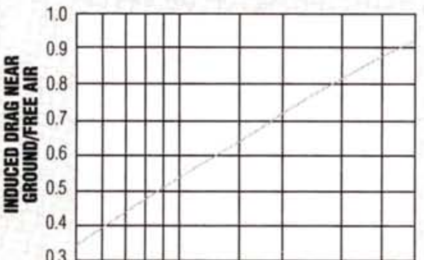


FIGURE 7. ***Impact of ground effect on the induced drag of a wing.***

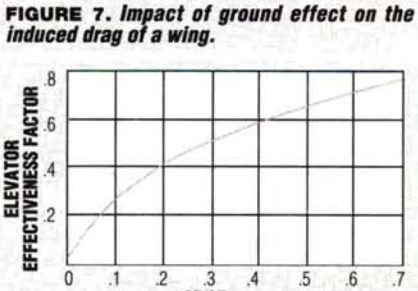


FIGURE 8. ***The elevator effectiveness factor and how it varies with the elevator's percentage of the horizontal tailplane area***

FIGURE 5. ***The Crane's high angle of attack in the landing posture, expertly flown by Jack Schroder.***

GROUND EFFECT

When an airplane is on final approach and descends to half its wingspan above ground (or water) level, "ground effect" occurs. When a plane is in ground effect:

- The wing behaves as though it had a higher aspect ratio; lift increases and the stall angle of attack decreases. (See Figure 5 in Part 1 and Figure 6 in this installment.)
- The induced drag of the wing decreases. (See Figure 7.)
- The most important change is a severe reduction in the downwash angle to about half its value at higher altitude.

Lowering flaps causes an increase in the downwash angle and in the nose-down pitch; but the severe downwash angle reduction, due to ground effect, reduces the tail's download, causing the model to nose-down in a shallow dive. This is particularly noticeable for models with wide-chord (up to 30 percent of the wing's chord) slotted flaps.

This behavior requires considerable up-elevator force to both stop the dive and to raise the aircraft's nose to the near-stall touchdown posture.

ELEVATOR EFFECTIVENESS

The larger the elevator area, in proportion to the horizontal tail's total area, the more effective the elevator, as shown in Figure 8.

For slotted flapped models, an elevator area of 40 percent of the horizontal tail's area is suggested. This proportion provides adequate elevator authority to achieve near-full-stall landings, with flaps extended and in ground effect.

Without flaps, a proportion of 30 to 35 percent is adequate.

Full elevator deflection of 25 degrees, both up and down, is appropriate. This may, at first, prove sensitive but, with practice, has proven to be no problem. At high speeds, elevator low dual-rate is suggested.

CG LOCATIONS

The optimum center of gravity location is vertically in line with the wing's aerodynamic center at 25 percent of its mean aerodynamic chord.

There are, however, advantages and dis advantages inherent in locating the CG ahead of or behind the wing's aerodynamic center.

FORWARD CG (FIGURE 9)

A CG ahead of the wing's aerodynamic center has only one advantage. It improves longitudinal stability, since it increases the "stability margin." (See the article "CG Location" in the April '93 *Model Airplane News.*) A forward CG has these consequences:

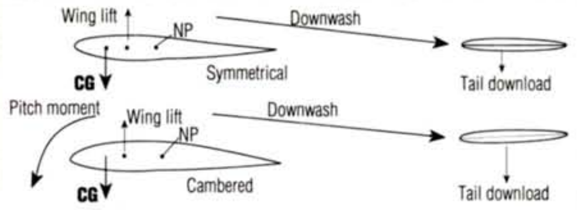


FIGURE 9. ***Forward CG force diagrams***

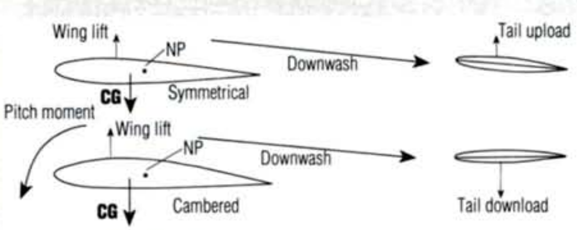


FIGURE 10. ***Aft CG force diagrams***

• The model's maneuverability is reduced, particularly when centrifugal force comes into play. (More on this subject further on.)

• The tail download to balance the forward CG adds to the load the wing must support, in addition to the model's weight. Profile and induced drags of both wing and tail increase. It is called "trim drag."

• In ground effect, and particularly for a flapped model, more powerful tail down-lift is needed to raise the model's nose for a flaps-down landing. This is more pronounced for wings using cambered (i.e., semisymmetrical or flat-bottomed) airfoils due to the wing's nose-down pitching moment. For symmetrical-wing airfoils the tail download need only balance the nose-down moment of the forward CG and the nose-down pitch from the extended flaps.

• The forward CG should be no farther forward than a point 16 percent of the mean aerodynamic chord, i.e., measured aft of the leading edge.

• With respect to any maneuver involving centrifugal force (and there are few that don't), that force acts at the CG and also substantially increases the load the wing must support. (See "Wing Loading Design" in the August '93 *Model Airplane News.)*

In a tight turn at high speed, centrifugal force increases the wing lift and the weight at the CG ahead of the wing's aerodynamic center. A force couple results that resists the turn. This imposes a heavy additional load on the horizontal tail that, even with full up-elevator, it may be unable to support—and it stalls—limiting the model's maneuverability.

For a CG vertically in line with the wing's center of lift (AC), these forces are directly opposed and do not add to the tail's load.

AFT CG (FIGURE 10)

A CG behind the wing's aerodynamic center offers advantages, but has serious potential disadvantages:

• Maneuverability is increased—centrifugal force acting on the aft CG actually reduces the tail loads needed for these maneuvers.

• Owing to the nose-down pitching moment of a cambered airfoil, the horizontal tail normally has a download requirement. The aft CG's moment about the wing's aerodynamic center reduces this tail download.

For symmetrical airfoils, the horizontal tail's airfoil is set at a positive angle of attack, *relative to the downwash,* to produce an upload to offset the aft-CG's nose-up moment. The wing's total load and trim drag are both reduced.

The disadvantages of an aft CG are:

• The stability margin is reduced, which could have serious implications for stability and flight control.

• Attempting to reduce trim drag by moving the CG too far aft can cause problems. This requires an increase in the tail's positive angle of attack for equilibrium. In a shallow dive, the wing's angle of attack and lift coefficient both decrease. Since the downward angle of the downwash is proportional to the wing's lift coefficient, the dive reduces the downwash angle, and that angle becomes more nearly parallel with the fuselage center line. The tail's angle of attack and lift increase, resulting in a sometimes violent "tuck under." Soaring gliders with CGs so located have lost wings in the resulting steep dive. Moving the CG forward and reducing the tail's angle of attack is the remedy.

• This author is nervous about the use of an aft CG coupled with slotted or Fowler flaps. The large increase in downwash angle created by the extended flaps could change the tail's angle of attack substantially, converting a positive upload (or mild negative download) to a heavy download. The combination of an aft CG and a heavy tail download might well result in a disastrous stall.

FIGURE 11

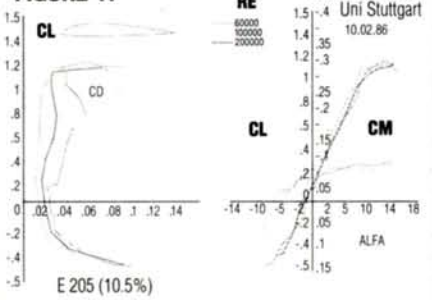


FIGURE 12

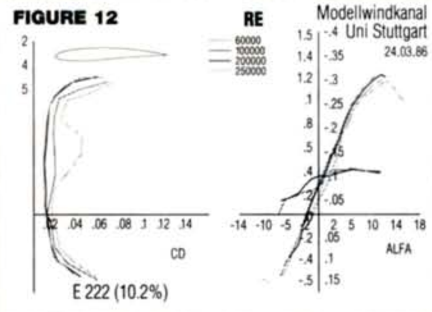
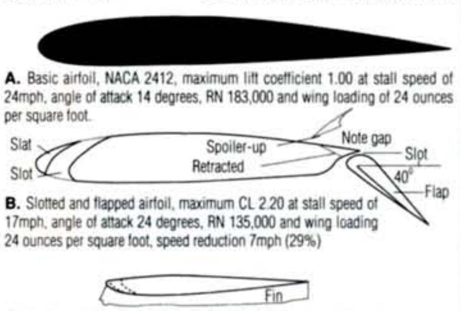


FIGURE 13 **CRANE WING AND TAIL SECTIONS**



A. Basic airfoil, NACA 2412, maximum lift coefficient 1.00 at stall speed of 24mph, angle of attack 14 degrees, RN 183,000 and wing loading of 24 ounces per square foot.

B. Slotted and flapped airfoil, maximum CL 2.20 at stall speed of 17mph, angle of attack 24 degrees, RN 135,000 and wing loading 24 ounces per square foot, speed reduction 7mph (29%)

C. Horizontal tail-plane section, NACA 23009, inverted and slotted.

NEUTRAL POINT MANIPULATION

There are ways to have both a modestly aft CG and a healthy stability margin between the CG and the neutral point. The major factors influencing the neutral point's location are:

• The relative size of the areas of the horizontal tail and wing. Enlarging the tail will move the neutral point rearward for a larger static margin.

• Similarly, a longer tail moment arm will move the neutral point aft.

• The relative vertical positioning of the wing and horizontal tail has a significant bearing on the tail's effectiveness or efficiency. A tail located close to the wing's wake, in heavy downwash, loses effectiveness. As explained in Part 1, at this location, the tail is in reduced dynamic air pressure caused by the drag of both wing and fuselage. This reduces that tail's effectiveness to under 50 percent. In contrast, a T-tail is 90 percent effective.

This reduced efficiency affects the neutral point location. It acts like a reduction in tail area; it moves the neutral point forward and reduces the static margin. The larger the vertical separation between wing and tail, the better. For models whose wing is on or in the middle of the fuselage, a T-tail is best. For high wings above the fuselage, a low tail is indicated.

There is another aspect to all this. For the same neutral point location, a high, more efficient tail may be reduced in area, yet would have the same effectiveness as the lower, larger tail. If made larger in area, the more efficient higher tail will move the neutral point aft, thereby enlarging the static margin.

Structurally, a tail in the fuselage presents few problems. A T-tail does impose heavy loads on the vertical fin. If thicker symmetrical airfoils, such as the Eppler 168 or NACA0012, are employed for the vertical tail along with stressed-skin construction (see "Stressed Skin Design, Part 2," in the October '92 *Model Airplane News*—specifically Figure 4B on page 17), the fin will have adequate strength. (See also the "Swift" construction article in the September '93 issue of *Model Airplane News.)*

A simple formula for estimating the most aft CG location, but still leaving an adequate static margin for safe, controllable flight is:

$$.17+\left(\frac{.30\times TMA}{MAC}\times\frac{SH}{SW}\times HTE\right)\times 100 =$$

CG location, in percent of the MAC, measured from the MAC's leading edge.

DEFINITIONS:
TMA = tail-moment arm in inches
MAC = mean aerodynamic chord in inches
SH = horizontal tail area in square inches
SW = wing area in square inches
HTE = horizontal tail efficiency, estimated at between 40 and 90 percent and based on the tail's vertical location relative to the wing's wake

This formula reflects the fuselage's contribution to the neutral point location. Depending on its size and shape, the neutral point can advance up to 15 percent of the wing's MAC under the fuselage's influence. Calculation of the fuselage's contribution is complex and beyond the scope of this article.

Using the Swift's actual and imaginary modified values will illustrate all this.

ACTUAL SWIFT VALVES
TMA—25.5 in., MAC—9.75 in., S—120 sq. in. SW—600 sq. in., HTE—90 percent

MODIFIED SWIFT VALVES
TMA—29.25 in., MAC—9.75 in., SH—150 sq. in. SW—600 sq. in., HTE—90 percent

REFERENCES

Those readers who want more information on wake and downwash are referred to the old, but excellent, NACA reports:

- Report 648 "Design charts for predicting downwash angles and wake characteristics behind plain and flapped airfoils."
  Authors: Silverstein and Katzoff, 1939
- Report 651 "Downwash and Wake Behind Plain and Flapped Airfoils."
  Authors: Silverstein, Katzoff and Bullivant, 1939

Source: National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.

The actual most rearward CG is at 31 percent of the MAC. Since the design CG is at 25 percent MAC, there is a healthy static margin. In the modified version the most rearward CG would be at 37 percent of the MAC.

Thus, the modified version would also have a healthy stability margin with a CG at 31 percent of the model's MAC, well behind the wing's aerodynamic center of lift at 25 percent MAG.

CAMBERED AIRFOIL SECTIONS

Semisymmetrical or flat-bottomed airfoil sections may be used in the horizontal tail. They have a wider range of angles of attack before the stall and a higher lift coefficient at the stall than symmetrical airfoils. Where a power-ful up or download is required such sections are useful. For uplift, the tail airfoil is right side up; for downlift, the airfoil is inverted. It should be noted that a cambered airfoil starts to lift at a negative angle of attack, not zero degrees as for symmetrical sections. The Eppler 205 section (see Figure 11) and the Eppler 222 section (see Figure 12) are suggested as tail airfoils. Note the shift to lower negative angles of zero lift at low Reynolds numbers.

An example of the need for a powerful download, in ground effect, is the "Crane," a Stol model. This model had full-span, fixed, leading-edge slots, and, flaps down, it stalled at 20 degrees angle of attack. After some trials, this model was able to achieve full-stall landings, as shown in the photo. An all-moving tail with an inverted, cambered and leading-edge-slotted airfoil, called a "stabilator," as in Figure 13, was required.

Hopefully, this discussion of tail design has proven interesting and informative. ■

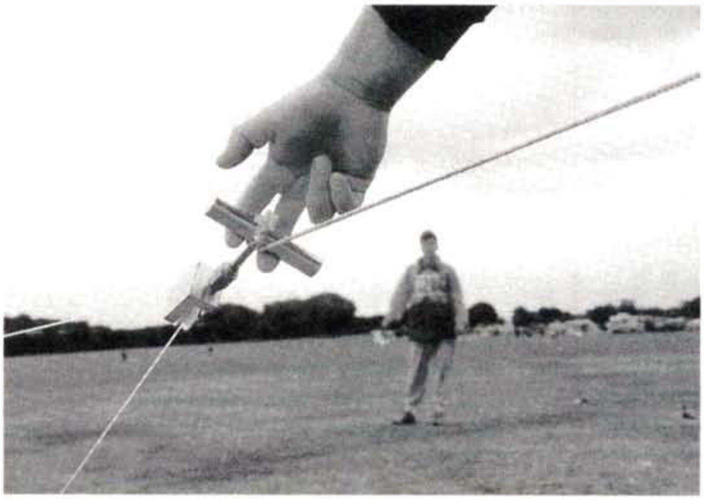
CENTER ON LIFT

MICHAEL LACHOWSKI

HAND TOWING

HAND TOWING is easy, enjoyable, and it makes for great competition. This month, I'll tell you what you need to start hand towing and how to tow easily even in calm air.

Hand towing is an interesting way to launch sailplanes. Many people think that hand towing requires substantial athletic abilities, but actually, it's quite easy. You've probably launched a sailplane on a high-start. You stretch the high-start and throw the sailplane. To hand tow, you don't need to pull any more than on the high-start pulls, so strength isn't much of a problem. With a good breeze, you can keep the model on the high-start by flying from side to side. The high-start stretch stays uniform, and the end of the line doesn't move. It works the same way for hand towing. With a breeze and a line with some stretch, you can stay on the line while the tow man stands in one place.



This pulley system is ready for action. The end of the towline (the lower line) is staked to the ground. This photo was taken by Sean Walbank at Interglide '92.

The official name for hand-tow sailplane contests is F3J. This event is a man-on-man thermal duration contest. Flying is done in groups, and you fly as long as possible in a 10-minute working window. You don't want to fly more than 10 minutes, because there's a 30-point penalty for exceeding the time limit, and landing points don't count if you land after the 10-minute working time. F3J rules evolved from the British Open Class soaring rules, and they include a 100-point spot landing on an FAI-style graduated landing tape. (This includes a 15-meter spot landing. Landing within 1 meter is worth 100 points, within 2 meters is worth 95 points, and this decreases to 30 points at 15 meters.)

After several qualifying rounds, the top pilots fly in one group for two fly-off rounds, which are 15 minutes long. Scores from the qualifying rounds don't count in the final standings, so the objective is to get into the fly-off rounds. This is a different philosophy from that of AMA-style contests.

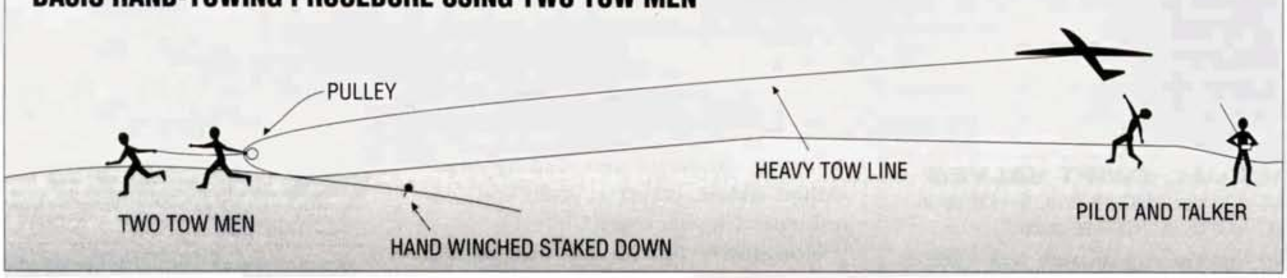
EQUIPMENT

You'll need one or two models and some tow lines for F3J. Model selection is interesting, because you'll want two different models to suit the time of day and the lift conditions during the fly-off. In good lift conditions, you need to launch as quickly as possible to maximize your flight time. Small, light, strong sailplanes can do this. If the lift is really good, a 2-meter design is perfect. During the early morning and in fly-offs, a larger model is more suitable.

High performance is important, so a large, high-aspect-ratio model is a good choice. The original British Association of Radio Control Soarers (BARCS) Open Class rules allowed a generous "in/out" type of landing, so some pilots used models with spans as large as 16 feet. This is a little too large to land well on an FAI spot landing, and it's impossible on an AMA spot landing, so you shouldn't see too many 16-foot-span models at F3J contests. Some of the larger AMA thermal duration ships would perform quite well in F3J. They are light, strong enough for hand towing, and they land very well.

Use monofilament line for the towline. It stretches more than braided

BASIC HAND-TOWING PROCEDURE USING TWO TOW MEN



lines. If you're flying a gas bag, such as an Olympic, you can use line as light as 40-pound test. The lighter line has more stretch and less drag during tow. For larger models and stronger wind, consider line up to 150-pound test. I normally use 120-pound test line, and I use the 150 for stronger winds. More than 100 pounds of pull from the model is needed to break a 150-pound test line. A strong wind can make it a challenge to hold on to the line. The official line length is 150 meters, and you can launch that high on a good tow.

Here's an action shot of a two-man tow. The tow is quick, and it works even on fast F3B sailplanes.

Here are two ways to store the line: the cheapest way is to buy one of those orange spools designed to roll up electrical power cords. (Some fliers use these spools for winding high-starts.) Or, buy a hand winch that's designed to rewind quickly and store the towline. Graupner* makes one (I bought my hand winch from Slegers International*).

COMMUNICATIONS

Communication between the tow man and the pilot are critical. You'll need to establish two signals: one to tension the line and one to start towing. Raising a hand might be a signal to tension the line, and lifting a leg is a good signal to start running. Allow the tow man to build some line tension before you throw the model. You should throw it firmly to avoid stalling at the start of the launch. The model will rise just as if it was launched from a high-start. Plan your release from the tow line before you fly over the tow man's head. You can get a respectable zoom from a hand tow in wind, but start it much earlier than you would on a winch launch.

TOWING TRICKS

What do you do when the weather is calm? Even high-start launches are bad when there isn't any wind during launch. I have an easy solution to that problem: use a pulley system. Instead of running with the end of the towline, stake it to the ground. The line runs through a pulley with a handle. The tow man runs with this pulley to tow the model. For every foot the tow man moves, the model moves forward by 2 feet. The pulley system doubles the speed, so you don't have to run as fast, and almost anyone can provide a good tow even in calm conditions.

The disadvantage of this technique is that you reduce the length of the line. The increased line tension accelerates the model upward during the tow, and the increased velocity more than compensates for the loss in line length. You can easily launch a 2-meter model in calm air in 15 seconds. For the really aggressive types, the pulley tow can be used in wind. Use a strong model, strong line and two tow men to pull. The Germans used this technique to launch their F3B models at Interglide '92.

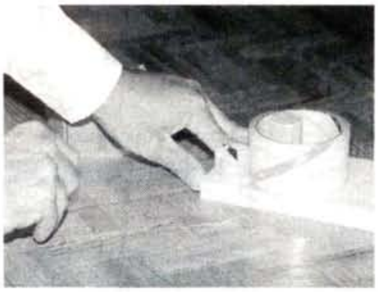
Hand towing is easy, and it requires very little special equipment. Contests are easy to organize, because everyone supplies his own launching equipment. Get some club members, and give it a try. Flying in groups is always more fun, not to mention some one-on-one flying.

HINGING

Tom Vaccarro shares this construction tip on how to strip tape to suitable widths for hinging. Scotch no. 845 book tape works well for tape hinges, but it's intended for repairing book bindings, and the narrow roll is 2 inches wide—much too wide for hinges. Build a tape stripper! Everything you'll need is in the photo: one dowel to hold the tape roll and a mount for a knife blade.

Constructing the stripper is simple. Cut two pieces of 2-inch dowel—one 1-inch-long piece for the knife blade and one 2-inch-long piece to hold the tape roll. Mount them on a board, and hold a no. 11 knife blade on the short dowel with a screw.

To operate the stripper, peel the end of the tape off the roll. Pierce the tape with the knife blade, and pull the tape past the blade to the desired hinge length. Keep the top side of the tape toward the blade mount and the sticky side out. If you pull off a little extra, you can stick the end of the tape to something, and let it hang until you apply it.



The tall dowel holds the roll of tape, and the short dowel holds a knife blade. Pull enough tape for the hinge; you'll get two strips of the same length. This is great for ailerons and flaps.

That's all for this month. It's time to start thinking about what to build for next summer!

** Here are the addresses of the companies that are mentioned in this article:*
Graupner; *distributed by Hobby Lobby Int'l., 5614 Franklin Pike Cir., Brentwood, TN 37027.*
Sleger's Int'l., *Rte. 15, Wharton, NJ 07885.* ■

HOW TO

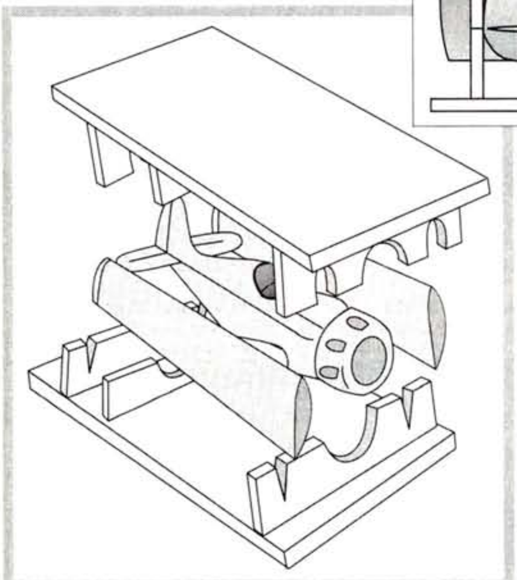
Make a Model Shipping Container

by RICHARD BAYLIS

End shipping damage worries with easy-to-obtain materials

HAVE YOU ever shipped one of your prized R/C model airplanes to an out-of-town event only to find it damaged on arrival? Or did you move to a new home and wonder how your models would survive the journey? The solution is simple: custom-design your own shipping container.

With two, large, heavy-duty, tri-wall corrugated-cardboard wardrobe boxes (available from U-Haul and many other major shipping companies) and a sheet of 2-inch-thick Styrofoam, you can transport your model without worry. It takes only a little time and very little cash to make



This shows how the cradle safely holds the model in place.

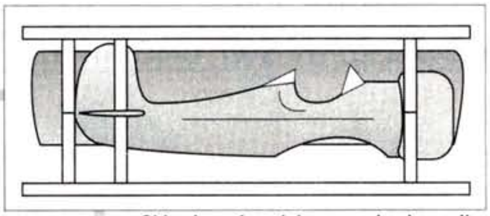
this shipping container, and you can also use it to store your models.

The container can transport a plane with a wingspan or length of up to 60 inches and a tail that isn't wider than 22 inches. I tested the container by shipping my 54-inch-wingspan Bucker Jungmeister to the U.K. from Canada and back again. The container and the Styrofoam inserts weigh about 15.4 pounds.

THE BOX

U-Haul wardrobe boxes have folding flaps at one end. Cut the flaps off both boxes. If you need a smaller container, cut one box—which will become the lid of the shipping container—farther back.

Reinforce and seal the ends of the cut



Side view of model suspension in cradle.

boxes with the adhesive tape.

Use some of the surplus cutaway material to make two, 18-inch-wide, L-shaped pieces that will fit snugly inside one of the boxes. They will form a lip over which the lid (the other box) will fit. Glue the pieces firmly into place with contact cement.

THE CRADLE

Cut the Styrofoam into two 2x8-foot pieces. (I drew on the Styrofoam with felt-tipped marker and cut it with an electric carving knife.) Cut two pieces 2 inches shorter than the inside length of the container—approximately 5x2 feet. Trim the 2-foot dimension to just fit easily inside the width of the container lip. (I used my Dremel saw set up to cut sideways.) Then I shaped the piece with coarse sandpaper on a sanding block.

Cut another piece of Styrofoam to fit

The foam cradle is placed vertically into the box with the lip glued into its open end. The other box (the lid) is then slid over the lip. Secure the container, and the model is ready for shipment.

snugly inside the nominal 24x21-inch dimension—the end of the box. Push this down into the box with the lip. It will be a pad for the spinner or prop nut.

Use the remaining Styrofoam to make close-fitting supports (a cradle assembly) for the fuselage, tail and wing cross sections. (See the illustration for a general idea of how to do this.) You'll need to plan how to support your particular model; making cardboard templates of the supports is helpful.

Then make three full-depth supports. Typically, you'll need one at the nose, one at the tail and one in between. I positioned the final support for my model just behind the rudder. This holds the wingtips in place over the tail of the plane, and it helps to prevent the fuselage from sliding back and forth.

MATERIALS

- Two 21x24x46-inch wardrobe boxes
- One sheet of 8x4-foot x 2-inch-thick Styrofoam
- Styrofoam adhesive
- Contact cement
- 2-inch-wide adhesive packing tape
- 40 feet of strong cord

The Styrofoam cradle assembly supports the model with custom-made cutouts and prevents the model from moving around in the container.

The total height of each supporting section will equal the inside height of the container (from its bottom to the top of the lip) minus 4 inches. Each supporting section should be horizontally cut in two at the widest point of the fuselage or at the wing cutouts, as appropriate. In fact, I cut the rectangles, marked the cutouts, cut the rectangles along the planned horizontal split lines and then finally made the necessary U- or V-shaped cutouts using the Dremel saw.

Glue the upright support sections into place on the top and bottom 5x2-foot Styrofoam sheets using the Styrofoam adhesive. After they have dried, test -fit them on the model, and trim and round off the outside edges of the Styrofoam so that the cradle assembly can be slipped into the container. Be sure that the assembly isn't loose inside the container.

With the top of the cradle in place, the entire assembly slides easily into the container. Notice that the tail of the model is supported with a Styrofoam upright. A similar upright (attached to the top of the cradle) supports the vertical tail.

For my model, I made a U-shaped section of surplus cardboard-box material to retain the interplane struts, the 1/4-20 wing bolts and a spare propeller between the wingtips at the tail end (after the pieces had been suitably wrapped). I also padded them with a piece of soft foam to prevent them from rattling around.

Place the model in the lower cradle assembly, put the top of the cradle over it, and slide the nose into the container. Place the container on end and position any small parts and padding. Then slide the lid over the lip. Secure the container with cord or packing tape, and you're ready to transport your plane safely!

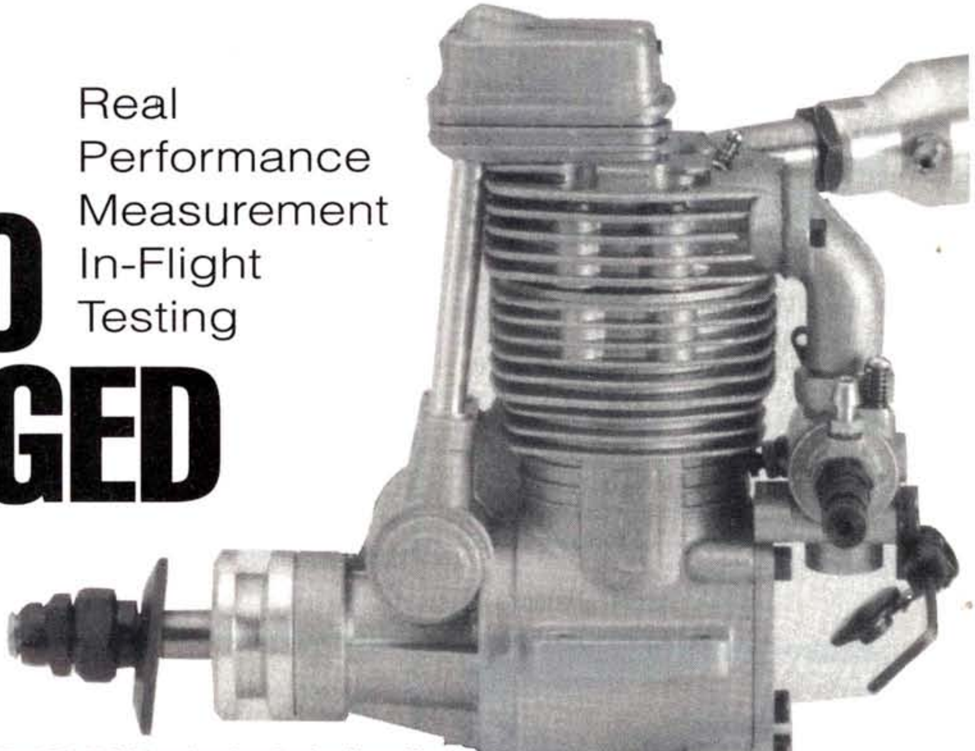
**Here is the address of the company mentioned in this article:*
***Dremel,** 4915 21st St., Racine, WI 53406.*

ENGINE REVIEW

ASP .80 FS RINGED

Real Performance Measurement In-Flight Testing

by DAVID GIERKE



The ASP .80 FS ringed engine after 2 gallons of fuel.

WHEN ISC INTERNATIONAL* introduced their new, made-in China, ASP .80 4-stroke engine, it was no surprise that it looked like an O.S. design—and why not? O.S. engines have proven to be a terrific performers with great longevity.

A highlight of the O.S. design is the front-mounted valve gear with pushrod-activated overhead valves. The transverse-mounted camshaft is driven directly from the crankshaft through cross-helical gearing, and the single camshaft has the cam lobes on either side of the centrally positioned timing gear. The camshaft and the crankshaft are supported by twin ball bearings. This type of valve-train design is good because it's easy to assemble: it doesn't require a separate pinion and shafts driven by the crankpin at the rear of the crankcase. The design is a winner! Why not copy it? Such is life for manufacturers in the highly competitive global marketplace. ISC and ASP readily admit that they wanted a successful design that they could market at a price that would beat the competition. Let's see how well they did.

The general appearance of the ASP .80 FS ringed 4-stroke engine leaves a favorable impression. The crankcase, cylinder head and rear cover die-castings are clean, but not quite as crisp as those on the O.S. product. The fasteners are all of the Allen socket variety—metric, of course. ASP includes adequate instructions, safety hints, warranty information and all the wrenches needed.

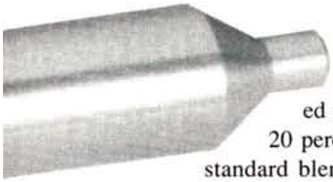
A potent-looking combination: ASP .80 and Air Trax 60 with telemetry; weight—9 pounds (dry).

I disassembled the engine and was then able to see how well it had been machined and how much attention had been paid to the use of the right materials. For example, the cast-aluminum connecting rod is bronze-bushed at both ends and has oil holes. The cylinder is chrome-plated steel. The light, cast-aluminum piston is fitted with a single cast-iron compression ring that's 0.025 inch from the top. The wristpin hole has been counter-bored on the front side of the piston from the inside—to act as a "stop" for the wristpin. A Teflon pad insert prevents the wristpin from scoring the cylinder wall. Poppet valves, rocker arms, clearance adjusters, valve springs, pushrods, lifters, cam and crankshafts all seemed to have been expertly made.

The carburetor is of the modern, twin-needle-valve variety. There are sealing O-rings on the ends of the aluminum pushrod covers and on the intake tube to the carburetor connection. A manual choke assembly is provided for the hard-to-reach, rear-mounted carb. Inside, the engine was clean—no metal chips or anything else that shouldn't be there.

BREAK IN

ASP recommends the use of "any good commercial glow fuel (preferably with 10 percent nitro)." ASP representative Alvin So suggested that I run the engine on 15 percent nitro and a minimum of 20 percent oil. Several manufacturers of 4-stroke engines now recommend that you use *less*



oil, so I decided not to exceed the 20 percent. In fact, my standard blend of 15 percent nitro, 10 percent Klotz KL-200 and 10 percent castor oil filled the bill nicely.

I decided to use the popular Fox* Miracle Plug because it retains heat in the same way as the O.S. model F does. The factory recommends a 13x6 prop, so the Zinger* 12x6 I used offered less load, which is desirable for break-in running. I used the supplied muffler for all runs.

The instructions suggest that you initially run the engine at 5,000rpm. My first run at an extremely rich needle-valve setting yielded 7,500rpm and a very cool head temperature of 130 degrees Fahrenheit (F). For the second run, I operated at about half throttle to reach the recommended 5,000rpm. I did this for six runs over 16 minutes of running time.

The cylinder head was cool enough to touch throughout each run—a 2- to 3-minute period. I also noticed that the engine wouldn't continue to operate when the glow heat was removed. For 18 minutes, I opened the throttle with a very rich needle setting at about 8,000rpm and a 150-degree F head temp. For the next 11 minutes, I leaned the mixture progressively to a fast, rich setting, and that allowed rpm to climb to 9,600 (head temperature: 280 degrees F).

After correcting a problem with the head temperature thermocouple—which *refused* to stay attached—I operated the

Engine break in: with a rich needle setting, note the smoke.

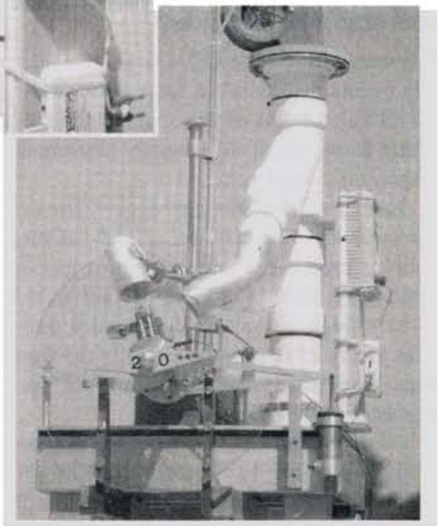
engine for an additional 12 minutes at the rich side of peak rpm, and it suddenly began to lose rpm. It dropped from a high of 10,000rpm to a low of 9,000rpm. I decided to check the valve lash. The clearance between the intake-valve stem and the rocker arm was about 0.100 inch—far too much. Further investigation showed that the pushrod wasn't extending far enough into the rocker box. Something was wrong down below—at the cam.

On disassembling the engine, I discovered that the intake-valve lifter (cam follower) had "mushroomed" where it touched the cam. The exhaust-side cam follower was fine. I also noticed that the entire cam/lifter compartment was dry—no lubrication. A quick call to Alvin at ISC elicited the information that some of the early engines were mistakenly shipped from the factory with cam followers that hadn't been heat treated.

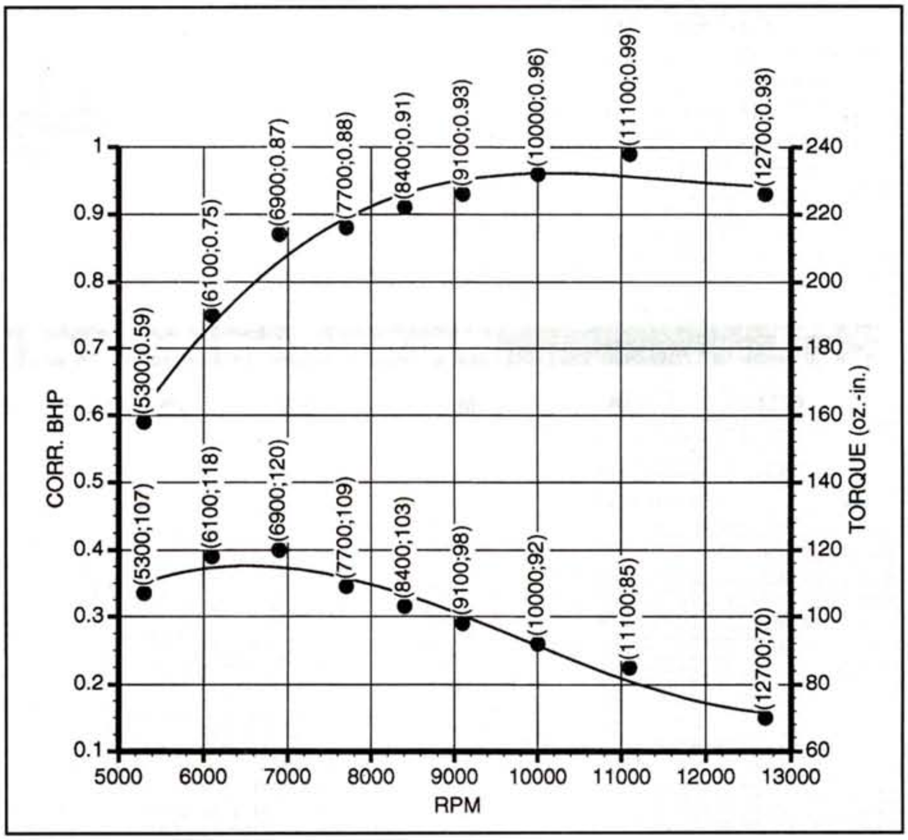
Rather than simply replace the faulty follower, ISC shipped me a new engine. The original engine's follower could have been replaced after a thorough cleaning (especially the ball bearings), but a new engine would leave no questions about the test results. Unfortunately, I lost an hour's break in, which would have to be repeated.

Alvin said that to ensure engine longevity, the cam cover should be removed after about every two hours of running for the purpose of manual lubrication with Marvel

Cylinder-head instrumentation—new for dyno.



The dyno with the ASP .80. Notice the new cooling system.



The ASP's "bathtub" combustion chamber with the carburetor and intake tube attached. A little quiz: which is the intake valve?

Mystery Oil, Snake Oil, Dura-Lube, etc. He claims that there's a basic design flaw in all valve trains of this type, and it prevents them from being properly lubricated, especially at high rpm.

Having received the new engine, I ran it through the break in described earlier. During early tests, at 8,000rpm or less, a noticeable amount of blow-by fuel exited behind the thrust washer, showing that there was plenty of lubrication going to the cam box. Interestingly, the flow decreased dramatically at above 8,000rpm!

After 79 minutes, I peaked the engine and, with the 12x6 prop turning at 10,500rpm, I checked the noise level at 9 feet: 94dB. The engine sounded much quieter than that to me—showing what an effect the *frequency* of the exhaust note has on *perceived* noise!

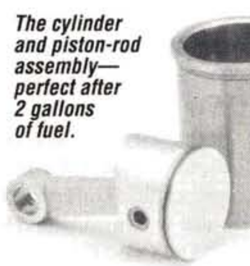
As you might expect, head temperatures continued to climb: toward 370 degrees F, as the engine was leaned to peak rpm.

DYNAMOMETER TEST

I mounted the engine on the improved dyno for calibration. In the photo, you see the new cooling system that I've installed. It may look funny, but it works well.

Remember that propellers are no longer used to provide engine load; pitchless "load beams" work well, but they don't contribute any cooling by means of prop blast. Cooling is now provided by a 150cfm (cubic feet per minute) squirrel-cage fan. The addition of cylinder-head-temperature monitoring allows me to know when to retrieve rpm and torque data. If you've performed engine tests using a given propeller and tachometer, you know that most engines will provide a high rpm (flash reading) when the engine is relatively cool, but that this rapidly drops off as the engine comes up to temperature. There are several reasons for this, including the different expansion rates of dissimilar metals in the engine, but the important thing to remember is: *this is a false reading and should be disregarded.*

I now set the needle valve near peak (on the rich side, of course) and allow the engine temperature to rise to a set point. At about 375 degrees F, I peak engine rpm and record the torque. In this way, I hope to obtain more meaningful and reliable data—an ongoing battle. A bit further down the engine testing road is exhaust-gas-temperature sensing with my newly acquired Ultra Wingman unit from Ultra R/C Products*. This will allow me to set air/fuel ratios as close to ideal as possible. More on this exciting development in coming articles!



The cylinder and piston-rod assembly—perfect after 2 gallons of fuel.

As indicated by the head temperature digital display (see photo), the twin blasts of cool air proved adequate for controlling the ASP's thermal load.

I anxiously began the dyno work to find the engine's torque and horsepower potential. After seven load beams had been tested (from highest load to lowest), the engine suddenly wouldn't start! There was no fuel to draw. On removing the valve cover, I found that the rocker-arm assembly had come completely loose from its mounting, which was secured by one machine screw. I also found that the cylinder-head bolt under the valve cover had loosened.

After tightening everything and setting the valve lash, I was again ready to test—from the beginning. With the rockers having come loose, earlier tests couldn't be trusted. Oh, well; it only dumped three hours' work! Engine testing isn't very glamorous.

Alvin later explained that the workers who test-ran the engines at the factory must have forgotten to re-tighten the bolts after the initial heating period. I usually do this before I test an engine, but I had cut corners to save time—wrong! There are *no* shortcuts! It's good practice to routinely tighten *all* fasteners after the initial operation of any new

Parts of the valve train.

DYNAMOMETER ASP .80 FS RING

RPM	TORQUE	CORR. B.HP	B.HP	CORR. FACTOR	DISTANCE (IN.)	Coefficient	56.3
5,000						Wet Bulb (F)	66
5,300	107	0.59	0.56	1.06	1.909	Dry Bulb (F)	78
6,100	118	0.75	0.71	1.06	2.096	Bar Pres (Hg)	29.31
6,900	120	0.87	0.82	1.06	2.131	Vap Pres (Hg)	0.6
7,700	109	0.88	0.83	1.06	1.936		
8,400	103	0.91	0.86	1.06	1.829		
9,100	98	0.93	0.88	1.06	1.741		
10,000	92	0.96	0.91	1.06	1.634		
11,100	85	0.99	0.94	1.06	1.510		
12,700	70	0.93	0.88	1.06	1.243		
13,000							

engine. (I can always mow the lawn tomorrow!)

The only surprise encountered when re-running the dyno test was the excessive crankshaft end play. (See "Misses.")

Notice that the chart shows a maximum torque of 120oz.-in. with a maximum horsepower of just less than 1 (corrected for atmospheric conditions). The graph shows a torque curve that peaks at about 7,000rpm and a corrected brake horsepower peak at about 10,000rpm. My graphing program uses the *least squares method,* and the curve doesn't always pass through the maximum recorded points; this is normal.

The interesting feature of this test concerns how the horsepower holds up beyond 10,000rpm. ASP recommends—and rightly so for a pushrod engine—that the engine not be operated beyond 11,000rpm. Beyond this point, the inertia loads—as well as the valve float brought on by valve-spring limitations—makes this a risky business. Notice that I start testing from high load/low rpm and work my way up the rpm scale on the dyno. The last load allowed the ASP to operate at 12,700rpm (which it did admirably), but—I'm no dummy—if it decided to blow up at that elevated point, I'd still have a completed test! That's a good hint for all you potential dyno testers out there: always run from high load/low rpm to low load/high rpm.

DYNAMOMETER RESULTS
Sample peak rpm and static thrusts

No.	Prop	Size	rpm	Static thrust (lb.)
1	APC	14x10	7,000	5.5
2	APC	14x8	7,700	6.375
3	APC	13.5x10	8,000	6.1
4	APC	13.5x9	8,200	6.0
5	APC	12x10	8,600	4.25
6	APC	13x8	9,200	6.375
7	APC	13x7	9,600	6.625
8	APC	12x7	10,500	6.25

From the dyno, practical wide-open throttle (WOT) rpm range was 6,000 to 11,000rpm. Next step: find flight props with the potential to allow the engine to operate in that range. Back to the test stand. The chart shows some sample peak rpm and static thrusts that Frank Vassallo and I obtained from a variety of APC* propellers.

We decided to fly props number 1, 3, 6 and 8 as a fairly typical cross section of the APC prop line, and because we thought they might perform well with the 9-pound, ready-to-fly (dry), Air Trax 60 test airplane.

FLIGHT TESTING

The difficulties encountered with the break in and dynamometer procedures put the ASP project behind schedule. My *Model Airplane News* deadline was rapidly approaching as Frank and I went to the flying field for flight evaluation.

As luck would have it, on the one evening we had set aside for telemetry data recovery, our field was alive with activity. When we finally got into the air, it soon became clear that we would never have enough time to evaluate the engine/propeller/airplane combination adequately with three other models in our flight path. As it was, we struggled to obtain meaningful data for the single propeller tested. This work requires total concentration, as well as close communication between Frank and me.

The APC 13x8 propeller turned 9,200rpm on the ground; straight-line air speed—81mph at 9,800rpm; loop speed—36mph at 8,500 rpm. The relative air density was 97.9 percent; a better performance could be expected in standard conditions. We had planned to compare the other APC props mentioned against these Zinger propellers: 14x6/10; 13x8; 13x6/10; and 12x7. They should also be in the rpm range needed for the ASP .80, but they weren't checked for rpm before the flight tests.

CONCLUSIONS

In the end, I found myself liking the way it pulled the Air Trax* 60 through the sky. It ran flawlessly and quietly—something that has been lacking from a few of our recent test engines. One feels a certain satisfaction when all the bugs have been worked out of a machine's operation—be it an automobile or a model airplane engine. The ASP .80 reminded me of a puppy that needed training to function as a disciplined pet. Now housebroken, the ASP is a joy to have around, and with proper care, it should last a long time.

HITS

- Looks good; good machine work/materials.
- Cost effective.
- Easy to operate, including a non-critical carburetor with reliable 2,400rpm idle.
- 90-day limited warranty on parts and labor.
- Fast, excellent ISC customer service.

(Continued on page 120)

F4D-1 SKYRAY

(Continued from page 33)

Be sure to fuelproof the duct tube and any other related internal parts. Test the workability of all the model's systems. Balance the model as described in the plan with the landing gear down.

Congratulations! You now have a "Ford" in your hands.

PERFORMANCE

After ground tests have been completed, I suggest that you use as much runway as possible for your first takeoff. (Later, takeoff can be made in 75 to 100 feet.) Climb and turn gradually, and adjust the trims for level, straight flight. Make another gradual turn and, if necessary, continue trimming. When you're satisfied, practice your landing approaches.

During my practice flights with the Skyray, I discovered that it hangs on at low-throttle thrust during the first stages of the landing touchdown. While checking the Skyray's maneuverability in subsequent flights, I discovered I needed to go easy on the sticks because the model is very quick and responsive; for example, it will complete a 360-degree axial roll in less than a second.

Now, if all goes well, you, too, will be able to enjoy the excitement of a "Ford" in your life!

**Here are the addresses that are pertinent to this article:*
S. Ginter, *1754 Warfield Cir., Simi Valley, CA 93063.*
OPS Motors; *distributed by Shamrock Competition Imports, P.O. Box 26247, New Orleans, LA 70186.*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
Tower Hobbies, *P.O. Box 9078, Champaign, IL 61826; (800) 637-4989.*
Rhom Products Mfg., *8425 S.W. 129th Terr., Miami, FL 33156.*
Eugene Martin, *5250 Hwy. 9, Felton, CA 95018.*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*

CERMARK SUKHOI

(Continued from page 41)

cut the Oracover into strips for all the pinstripes except for those on the engine cowl. I used Carl Goldberg ¼-inch-wide pinstriping tape and, for the numbers, Eagle Products* stick-on graphics (distributed by Dumas Products*). The red star on the tail and the name logo on the side of the fuselage come with the kit.

The model was completed in about 10 hours, including about two hours for priming and painting the fiberglass parts. With all the not-so-hard work out of the way,

(Continued on page 104)

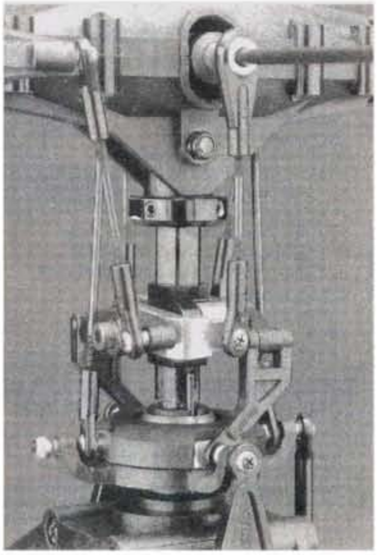
NEW HELI PRODUCTS

ALTECH MARKETING Bell 222 .30 Helicopter

This .30 helicopter features a main frame similar to that of the Hirobo Shuttle. It has an FZ rotor head, weighted blades and an autorotation clutch system. It has a tail shaft drive, and its retractable landing gear operates using only a retract servo. Designed for use with .32 to .35ci engines (such as the Enya SS35 Heli TN engine), the Bell 222 .30 can be upgraded to take larger engines. The fiberglass-reinforced plastic body is light and beautifully detailed. Molded parts add to its realistic look; a top-mounted hatch lets you access the top of the frame. Because the standard shaft starting socket is mounted in the top of the frame (which avoids having an unsightly hole for a starting cone or a belt), you can start the engine more easily.

Kit no.—0402992; **price**—$1,097.

Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.



GREAT PLANES Hex Mixing Base

The Hex Mixing Base is a new product from Kyosho's Zeal line of helicopter accessories. By reducing off-center rotation of the Concept 30 SR mixing base, it helps heli pilots avoid unwanted cyclic pitch and roll inputs. The Hex Mixing Base is constructed of CNC-machined aluminum; an alumite coating ensures that the components resist wear and abrasion and allow smoother performance and longer life. The Hex Mixing Base requires the use of the Concept 30 SR mast, rotor head and linkages. Pitch rods and complete instructions are included.

Kit no.—KYOE6307; **price**—$44.95.

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

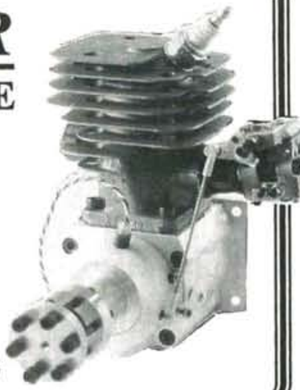
REVOLUTION Ball-Link Pliers

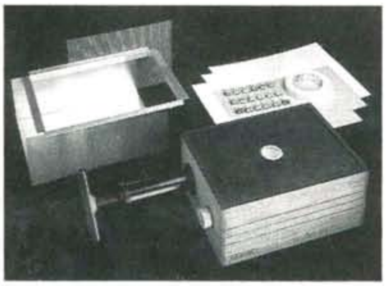
Featuring opposing pincers, these steel pliers will fit most standard ball links, and their black-oxide coating won't mar balls or links in any way. The pivot point on many pliers is a rivet that eventually loosens, but these pliers have an adjustable 3mm screw and locknut to ensure a consistently tight action.

Part no.—RVO1002; **price**—$11.95.

Horizon Hobby Distributors, 4105 Fieldstone Road, Champaign, IL 61821; (217) 355-9511.

Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor does it guarantee product performance or safety.





CERMARK SUKHOI

(Continued from page 98)

you'll just need to wait for a sunny day and head for the flying field.

**Here are the addresses of the companies mentioned in this article:*

Cermark Electronic & Model Supplies, *107 Edwards Ave., Fullerton, CA 92633.*
Ultracote; *distributed by Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651.*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Webra; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
Slimline Mfg., *P.O. Box 3295, Scottsdale, AZ 85257.*
Davis Diesel Development, *Box 141, Milford, CT 06460.*
PFM; *distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Hobby Lobby Intl, *5614 Franklin Pike Cir., Brentwood, TN 37027.*
JR Remote Control; *distributed by Horizon Hobby Distributors.*
Sullivan Products, *1 N. Haven St., Baltimore, MD 21224.*
William Bros., *181 Pawnee St., San Marcos, CA 92069.*
Eagle Products, *754 Dodsworth, P.O. Box 4609, Covina, CA 91723.*
Dumas Products Ltd., *909 E. 17th St., Tucson, AZ 85719.*
Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*

GOLDEN AGE

(Continued from page 60)

Austin Leftwich at one of Jim Thrift's annual NC/RC invitational flying sessions (from Charlie Spear's photo collection). The North Carolina group was a hotbed of early R/C, and Jim was their tireless leader.

Hornet, Dynamic offered the first ½A engine with speed control for R/C.

In the mid-'50s, Dynamic advertised that Johnson engines had dominated several events at the Nats, and that Lou Mahieu and Dennis Alford had set new national records using them. Also, the Holland Hornet did well in several more events. These are credentials of outstanding performance; I wonder why they didn't carry over into R/C.

The ½A Holland engines were so outstanding in their bracket that the wonder here is why the Cox engines went on to dominate the market. I just read a test report where a Holland Hornet was the equal of the latest

(Continued on page 108)

GOLDEN AGE

(Continued from page 105)

Cox models, and this some 30 years later!

Dick also reports that in 1960, Dynamic (with Holland's support) brought out a new line of vastly improved engines that included ones for R/C, but they weren't in the desired larger displacement range. Apparently the lifespan of this series was short because R/C was in its heyday and so demand for FF and C/L engines was small.

AUSTIN LEFTWICH

The D.C./Virginia area was a center of early R/C that produced many R/C leaders who led the way at flying sessions and contests. Some personalities stand out in a crowd, and the genial Austin Leftwich—whose ability and personality always brightened any flying event—was one of them. He was an admired leader in aircraft design and radio development. The photo shows his original design that was powered by an Anderson Spitfire with a speed controller. The guidance was a Leftwich development of Dr. Good's TTPW R/C system.

And so it goes until next time.

SIMPLE PROGRAMMING

(Continued from page 72)

ways. You can either use it as a "temporary on" switch for functions such as engine kill, or you can change its function to "pull on, pull off" to actuate one of the timers or stopwatch functions.

THR. The throttle-curve function is used in the helicopter and airplane modes, and it can be most useful in making the throttle response feel more linear. After turning it on in this section, you manipulate it in the "condition section."

SWH. Swashplate type allows helicopter users to choose among four swashplate control styles. This is like switching between delta, normal and flaperons in an airplane.

RDR. A helicopter's rotor direction—clockwise or counterclockwise—must be set before all the other conditions.

INV. Inverted pitch is used to set up a helicopter for inverted flight.

PIT. This is used to activate or deactivate pitch curve for helicopter programming.

COMMON-CONDITION SECTION

ATV. Adjustable travel volume is used to set the throw limits in each direction for channels 1 to 8. Included in this feature is a function called "servo delay," which smoothes the transitions between conditions that may have different servo neutral points.

AFR. The adjustable-function rate is the manipulation of the servo's response curve when applied to different conditions. It's most useful in mixing scenarios.

D/R. Dual rates allow you to use the switches on the face of the transmitter to change the amount of servo throw of any of the eight basic channels.

PMX. Programmable mixing allows you to combine channels to perform special maneuvers and/or functions, or to correct undesirable tendencies in your aircraft's flight performance.

STM. Use the sub-trim function to make fine adjustments to the servos during control hookup. Always start your setup in the neutral position.

TOF. Trim offset is used to soften the shift between different flight conditions.

CNA. Condition name registration uses up to five characters to identify a condition setup. When this function is activated, the name will appear in the top center of the screen.

TRM. Digital trim displays the position of the electronic trims and shows the current memory trim positions. You can also use it to change the amount of trim change speed and the size of each motion increment step.

The rest of the conditions are specific to airplanes, helicopters, or gliders.

CONCLUSION

This radio definitely sets a new standard for completeness of programming. Add to this its ability to synthesize channels, and you can see that Futaba has brought to the market a real tour de force. The radio costs a little more than others, but if you spread that cost across a number of models, the value is well worth it. I was so impressed that I bought one for myself at my favorite hobby shop.

Till next month, happy landings!

**Here's the address of the company featured in this article:*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*

RPM: ASP .80

(Continued from page 97)

MISSES

- Needs a more detailed, 4-stroke-cycle instruction sheet.
- To prevent excessive shaft end play, a loose front crankshaft bearing had to be secured with Loctite.
- Loose head and rocker-arm machine screws (quality control at the factory should be improved).

I can't emphasize enough the importance of *bench testing* and *break in* for any engine before you mount it in a model for flying. Can you imagine the grief we save ourselves by finding problems on the ground rather than in the air? By the way, Alvin So recommends a 3-hour break-in. Do it on the bench!

**Here are the addresses of the companies mentioned in this article:*
ISC Intl., *P.O. Box 40116, Indianapolis, IN 46240.*
Fox Mfg. Co., *5305 Towson Ave., Fort Smith, AR 72901.*
Zinger; *distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.*
Ultra R/C Products, *5455 Linger Longer Rd., Cumming, GA 30130.*
APC; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*
Air Trax; *distributed by L&R Aircraft, 13645 Fisher Rd., Burton, OH 44021.*

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10TH ANNUAL FLY-IN FESTIVAL at the R/C World flying site in Orlando, FL. Join the fun on Thanksgiving Weekend (Friday, November 26 to Sunday, November 28). This is an AMA-sanctioned Class C event. Aircraft noise must not exceed 99dB at 3 meters; AMA safety code and weight limit apply. Contact Dixie Cutrone (CD), 1862 Mahogany Dr., Orlando, FL 32825; (407) 380-6359. Need accommodations? The **R/C World condos** are available for a super R/C and Disneyworld vacation, but they *must* be reserved *in advance*. Contact Lonie Charlson, (407) 380-6359. [12/93]

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

WANTED: model-airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/94]

P/C—THE EASY WAY to simulate metal panels; $1 gets information and sample. Clarke Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [12/93]

1930s to 1950s MODEL AIRPLANE MAGAZINES—1930s aviation pulps—complete and in good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada, M5M 1W. [12/93]

LOCKHEED P-38 LIGHTNING—Are you a P-38 Lightning fan?—R/C models or full-size? Join the P-38 Model Organization International! For more information, send $1 to the P-38 Model Organization International, Medelbyvej 54, 2610 Rodovre, Copenhagen, Denmark. [2/94]

MISSILE SECRETS—engines, rockets, U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

WANTED: old engine parts, misc. junk before 1970. Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

R/C FLIERS' DREAM COME TRUE. Vacation with your family, and bring your R/C plane! R/C World is a radio-control community with beautifully furnished condo (pool, tennis included), and one of the world's finest flying sites. All this only 20-30 minutes from Disney, Epcot, Universal Studios, Seaworld, and about 1 hour to Kennedy Space Center. For more information, call or write to Dave Patrick, P.O. Box 1385, Oak Park, IL 60304. (708) 771-6697. [1/94]

CLEVELAND KITS (AND PLANS) WANTED: Immediate cash, call or ship for offer. Ship to Jay Herbert, P.O. Box 1286, Mattituck, NY 11952. Phone (516) 298-4135 or fax (516) 298-4181. [3/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGE:100 pages—timers, needle valves, orginal cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [2/94]

MAGAZINE BACK ISSUES—Flying Aces, Model Airplane News, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [2/94]

WANTED—World War II and postwar recognition models. Old toy airplanes, cars, trucks, Zepplin, etc. Bill Fornwalt, 103 Dartmouth Ave., Johnstown, PA 15905. [11/93]

IMPORTED DIESEL ENGINES—world's best selection: AE, AM, Aurora, Cipolla, KMD, MAP3, Mikro, MK-17, MVVS, Modela, PAW, Pfeffer, Letmo and USE diesels, plus very special imported glow engines, CO_2 motors and sailplane kits. Ten-page catalogue—$1. Carlson Engine Imports, 814 E. Marconi, Phoenix, AZ 85022-3112.

SCALE WW I Plans: Send $1 for current list. "Smileys," 23 Riverbend Rd., Newmarket, NH 0385. [2/94]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03)2128192.

FREE—Tesla turbine plans. Contact Dan, 1214 N. 6th St., Port Hueneme, CA 93041. [2/94]

WANTED—Kraft KP-4/6 from 1964-66. Karlheinz Schmid, Stieranger 7, 8900 Augsburg 21, Germany. [2/94]

MONTHLY R/C SWAPMEET delivered to your door! Nationwide buy/sell/trade newsletter with quick turnaround. Free sample copy and ad coupon. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521, 24 hrs. [12/93]

INTERNATIONAL AIRCRAFT RESEARCH—need documentation? Include name of aircraft for availability of documentation with $3 for photo and three-view catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J 3G3. [11/93]

PARACHUTIST! Release a scale-like parachutist! A real crowd pleaser and a lot of fun! For a brochure and jump contest rules, SASE: Hobby Hut Mfg., 2040 W. 21st St. N., Suite #77, Dept. MAN, Wichita, KS 67203. [3/94]

GIANT-SCALE PLANS—Blohm and Voss BV-138 3-engine flying boat plus other maritime aircraft. Two stamps for listings. Gene Falada, Sea-Clusion Aeronautics, 22W070 Byron St., Addison, IL 60101. [11/93]

INSTRUCTORS SCARCE? Our VHS R/C flight instruction tapes will get you started! Free catalogue! Silicon Valley R/C Technologies: (800) 822-1500. [12/93]

WANNABE PRIVATE PILOTS! Find out what it *really* takes, not just how to become one. Comprehensive report reveals how to save time, frustration and money getting your wings. Free details! Stangel Aviation, 1034 Riverbend Dr. #12M, Hartford, WI 5302. [11/93]

QUIET YOUR ENGINE with Koosh-In-It—a flexible, rubber-fabric laminate that "softens" engine vibration. Install it between the engine, engine mount and/or firewall. Pad measures 2 1/2x4 inches and is 1/16 inch thick, and it can be cut easily with blade or scissors. Only $5.80, postage-paid. Balsadust, P.O. Box 078, New York, NY 10021-0078; (212) 737-0071. [3/94]

WRENCHES AND GASKETS for vintage and newer engines Bob McCord 325 Sylvan Mountain View, CA 94041. [3/94]

SCALE DOCUMENTATION-MODEL PLANS—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalogue: $2 (post-paid). Bill Young, 8106 Teesdale, N. Hollywood, CA 91605. [4/94]

"VACUUM FORMING." This 128-page illustrated book shows how to make light plastic parts. Get professional results with low-cost equipment. Over 7,000 copies sold. Try it for yourself—$9.95 (plus $1.05 S&H). Coming this fall: complete machines, components and supplies. Vacuum Form, 272 Morganhill Dr., Lake Orion, MI 48360; (800) 391-2974. [11/93]

GRAND OPENING—Magic Tunes Catalogue. CDs, tapes and accessories for your listening pleasure. Grand opening prizes, giveaways, gifts, special offers. Send $2 to Box 65031, Los Angeles, CA 90065. [12/93]

WANTED—Guillow's discontinued 100 series World War I kits, deHavilland 4 kit: no. 205; World War II Mosquito kit: no. 804; Airacobra kit: no. 806. Collector will pay top prices. George Santikian, 7285 N. Channing, Fresno, CA 93711; (209) 439-3363. [11/93]

WANTED—unfinished Mark Frankel's Lear 35A; reasonable price. Rich, 2809 Skyline Dr., West Mifflin, PA 15122; (412) 466-7292. [12/93]

HELICOPTER SCHOOL—five days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [12/94]

FOUR 1993 SCALE CATALOGUES. SPPS super-scale plans; SPPS scale documentation; ASP scale plans handbook; ASP aircraft scale drawings handbook (three-views). Catalogue—$5 (overseas airmail, add $5 for one to four catalogues); 140 different scale plans; 120,000 photos; Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

IMPORTED DIESEL ENGINES—world's best selection: AE, AM, Aurora, Cipolla, KMD, MAP3, Mikro, MK-17, MVVS, Modela, PAW, Pfeffer, Letmo and USE diesels, plus very special imported glow engines, CO_2 motors and sailplane kits. Ten-page catalogue—$1. Carlson Engine Imports, 814 E. Marconi, Phoenix, AZ 85022-3112.

ANTIQUE AIRPLANE PRINTS, 8x10 color prints. Stearman, Gee Bee, Waco, Jenny, P.T. Ryan; 10 in all. Send $1 (refundable) for color brochure. Robert Kohr, P.O. Box 204, York, PA 17405. [5/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). Specify needs. Send SASE and 60 cents for list. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

OLD MODEL MAGAZINES. Send SASE for list to Dave Bessel, P.O. Box 669, Poway, CA 92074 [2/94]

PAYING $50 each for toy metal outboard boat motors. Oliver, Evinrude, Johnson, Gale, Wen-Mac, Sea-Fury, etc. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [5/94]

WANTED: Coverite 2-inch-scale lozenge-pattern covering material. Russ Campbell, P.O. Box 7615, Tacoma, WA 98407; (206) 759-6089. [12/93]

THE TOOL RESOURCE has the right tool for the right job—the finest quality hand tools, soldering equipment, tool bags, etc., specifically for hobbyists, technicians, service professionals. Current catalogues available. Write: The Tool Resource, Dept. MA, P.O. Box 1106, W. Dundee, IL 60118; fax (708) 468-0849. [2/94]

WANTED: E-Z floats—32 inches or longer. Richard Stearns, 1275 Forest Glen, Winnetka, IL 60093. [12/93]

WANTED: full-size Monogram catalogues. Quantity, year, condition, price (each), shipping charges and daytime phone number (first correspondence). John Bickett, P.O. Box 38383, Colorado Springs, CO, 80937-8383. [2/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to quarter scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [2/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [5/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

PC-PERFORMANCE—easy-to-use, menu-driven computer program predicts flight performance of R/C model aircraft. For IBM PC compatibles with monochrome or color graphics capability. Introductory price—$15 plus $3 S&H. Specify disk format. Softair, 10710 Evergreen Way #D305, Everett, WA 98204. [12/93]

CUSTOM-BUILT MODELS: 17 years experience. Will build your R/C project. Quality craftsmanship, reasonable rates, satisfaction guaranteed. Specializing in ducted fan and giant scale. Giant Scale Models, 1603 N. Main St., Ste. E, Anderson, SC 29621; (803) 224-0797; fax (803) 225-4465. [2/94]

FREE ASP AIRCRAFT PLANS LIST. Master list of plans published in British magazines. Send large SASE for list; send $6 for "Best in Scale" catalogue. Bob Holman Best in Scale, P.O. Box 741, San Bernardino, CA 92402; (909) 885-3959. [1/94]

GIVEAWAY! (NPN) one each L-1011, 727, 737, MD88, 767 scale 1:600. Send registration fee—25 cents—with name and full address by November 30. Specify aircraft choice. Wellborn (scale), 562-S Oak Dr., Lexington, SC 29073-9536. [12/93]

WANTED—control-line profile kits: Midwest P-63, Skyraider, P-51, ME-109, Sterling Navion, Starfire, Skyshark, P-40, Sportster. Throttles: Rotovalve, Dynamic 19/60, McCoy 19/35 RD/BL, K&B 19/35 grn. Engines: McCoy 19/35 R/C RD/BL, three-line bellcranks. Paul Patterer, 114 Mosher Ave., Battle Creek, MI 49017; (616) 965-5364. [12/93]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/94]

FOR SALE: O.S. .61 Hanno, N.I.B.—$295. Futaba 5UAP, like new—$185. Call Mike, (814) 835-2044. [1/94]

ARE YOU TIRED OF PAYING $1.29 for six screws? For a *free* catalogue and price list of screws, nuts, locknuts, blind nuts and more, in sizes from 0-80 to 1/4 inch, contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (800) 892-6917; fax (908) 788-2607. [5/94]

PAYING $100 each for gas-powered, metal, thimble-drone race cars. Wanted: tin, wind-up, toy airplanes. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [12/93]

FUTURISTIC DUCTED-FAN CONSTRUCTION VIDEO: A revolutionary way to build a ducted-fan, delta canard R/C aircraft with vectored thrust. The video takes you step by step from computer design construction to the actual flight. The aircraft is designed for easy building, high- and low-speed maneuverability and vertical flight capability. It's lightweight and *affordable*. On sale, late summer. For *free* details, prototype spec sheet and updates, write to MVP, 2 Hinrichs Pl., Ste. 2, Bloomfield, NJ 07003; (201) 680-0331.

R/C COMPOSITES—Example: carbon fiber, 100' 0.25" by 0.007" tow—$5.75, postage-paid; send SASE for example applications sheet, free samples and price list to R/C Composites, P.O. Box 832, Newark DE 19715. [2/94]

SCALE AIRCRAFT DOCUMENTATION and RESOURCE GUIDE. World's largest commercial collection. Over 5,000 different color Foto-Paaks and more than 22,000 three-views; 152-page resource guide/catalogue—$6; Canada—$7; foreign—$12. Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [2/94]

MONTHLY R/S SWAPMEET delivered to your door! Nationwide buy/sell/trade newsletter with quick turnaround. Free sample copy and ad coupon: *R/C Trader*, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [12/93]

video views

by JEF RASKIN

TOP GUN 93
Back with the best

Subject: *The prestigious all-scale competition succeeds yet again.*
Source: *Telstar Video Productions, 1501 S.E. Decker Ave. #109, Stuart, FL 34994.*
Summary: *Well built, well-flown and well-taped.*
List price: *$24.95 plus $3.25 S&H and 8% tax*
Rating: ✈ ✈ ✈ ✈
Approximate length: *Two tapes, 90 minutes and 75 minutes; 2 hours, 45 minutes total*

What can one say about seeing models that are all we ever dreamed of when we cut little doors in our first simple scale models and tried to imagine them with a full complement of operational detail? Perhaps it would be easier to say it if I weren't drooling so much.

First and foremost, get these tapes to see the planes, shown on the ground in luscious, loving, screen-filling detail and in the air in steady, clear view. I suspect that all 60 Top Gun entries are shown—one at a time, the way they should be. I tried to count the models as I watched, but lost track of the different types at 47 aircraft and, since there were about six zillion F-86s and enough F4D Skyrays to overload an aircraft carrier, I got hopelessly lost in my overall count.

Here's a partial list: Zero, Skyraider, Skyray, P-35, C-47, DC-3, Stuka, T-33, Lear 35, Beech Starship, Vickers Vimy (they had two m's in their caption, but nobody's perfect), Albatross, Waco SRE, T-34, F-86, Rearwin Speedster, F8F, Spacewalker, Meteor Turboprop, Sopwith Pup, Nieuport 28, AN-2, P-39, P51B, T1, Tempest, Ryan STA, F-14, Yak 11, Hellcat, Stormovik, F4, F6F, Fokker D-VII, Wilga, Sopwith Triplane, KI-84, O2A and the obligatory Piper Cub. Did I mention the ag plane, Spitfire, F18, F-104 and Sopwith Snipe that flew by? We see every airplane take off, do a slow- and a high-speed pass and land. For a few, you get to see an aerobatic maneuver or a scale operation, such as a fuel-tank drop. It is this complete coverage that led to the need for nearly three hours of coverage—a TV station would have put the whole thing into a 30-second spot and I would have hated it. But we modelers want to know how each plane looks in detail and how it handles in the air.

Only the most jaded will find this production overly long, and even they will be impressed when the announcer informs us that the parts cost of one of the models entered is somewhere between $7,000 and $8,000. Want to buy it ready to fly? It would cost about the same as some full-size planes—about $15,000 to $20,000. Of course, for that money, you can't buy a full size twin-engine, swing-wing, retractable-gear prize winner. I am not sure that I'd want to fly a model plane that expensive. Even with my 99.2-percent-safe landing record, that's an expected risk of about $200 per flight!

The camera work is, for the most part, topnotch. The close-ups are sharp, from the rivets on the cockpit to the insignia on the tail. In the air, the planes are beautifully tracked with lenses so powerful that you can often see the control surfaces in operation. The producer wrote a note to me saying that he thought I would "be impressed by the overall improvements we have made" (since the last tape of theirs I reviewed). I was ready to say, "Oh, yeah?" But he was absolutely right. Their previous efforts were pretty solid, but now they have great coverage of the event and good production, too. Even the interviews—usually stretches of slack water between the rapids—are interesting and informative (even if I could do without the title that predicts, "An Exciting Telstar Interview" before each one). The opening interview with contest organizer Frank Tiano was full of useful information about how the contest works. It is not dull talk-talk, but sets the scene and helps get you oriented—something that is done badly, if at all, in most model plane videos.

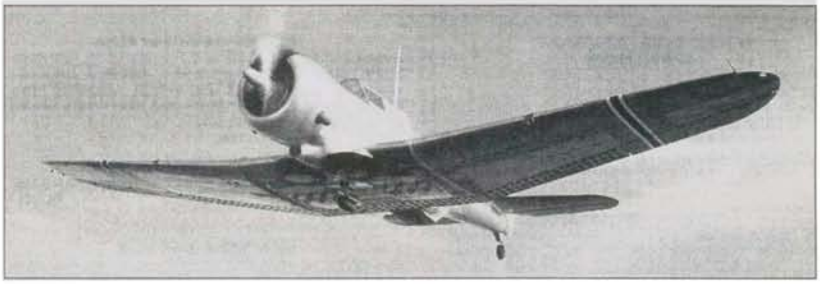
Again held by the Palm Beach Aero Club at a polo field, the event seemed to run extremely smoothly. "Unsmooth," however, was the grass runway that made some of the small-wheeled jets jounce around in a very un-scale-like manner, although it was perfect for the large-wheeled biplanes. Maybe next year we'll see a scale-surfaced runway for the scale jets. The organizers owe that much to the builders and pilots.

The second reel begins with a few crashes; apparently, the survival factor was much better this year than last, as there weren't many. Slow motion is very effective in showing just what happened. On a softer note, the European competitors managed to get their airplanes a whole lot quieter than ours, and it seems we have something to learn in this regard. I can't tell whether it was the script or that the narrator was winging it, but a number of small errors and malapropisms crept in: for example, a plane was said to pull between "50 and 100 Gs" (no way, Jose); some fuel-tank releases were called "bomb drops"; the EAA was called the "Experimental Air Association," and "accentuation" was said where "activation" was meant. But these slips were far and few between.

From the opening graphics to the tumbling lunch time air show to the closing credits, this double-length video is a winner, and it gets an unqualified recommendation as a video nearly as good as the nearly perfect models it shows us so well. If you like scale, you'll like this video, but be sure to remove the plastic tabs that will prevent these tapes from being accidentally erased.

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?



If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Wil Heffelfinger of Lansford, PA, for correctly identifying the September '93 mystery plane. General Motors (Fisher) built the XP-75 Eagle to meet the USAAF's need for a plane with increased climb performance. In 1942, the original concept was a large, single-seat fighter that had the outer wing panels of the P-51 (in an inverted gull configuration), the tail of the A-24 Dauntless and the landing gear of the F4U Corsair. It was powered by a then untried Allison V-3420 engine (mounted in mid-fuselage) driving contra-rotating props with twin shafts running under the cockpit. In 1943, two prototypes were ordered that had the outer wing panels of the Curtiss P-40.

In 1944, the USAAF changed its requirements; they wanted a fighter that had long-range performance. They agreed to buy 2,500 of the production model P-75 if the prototype's performance figures were proven in the air. From the start, the fighter had poor stability and spin characteristics, unsatisfactory ceiling and poor engine cooling, and these contributed to the cancellation of the program. Although most of these problems were corrected, the need for the aircraft was eliminated when the P-51 Mustang fulfilled the requirements for a long-range bomber escort in Europe, and the P-47 and P-38 Lightning served satisfactorily in the South Pacific. Six P-75s were built in all; only five ever flew.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

SAN GABRIEL VALLEY RADIO CONTROL LEAGUE
P.O. Box 9052, South El Monte, CA 91733-0292

This isn't the first time that the San Gabriel Valley Radio Control League has been our "Club of the Month." This active club combines news, tips, event information and humor in their professional, easy-to-read monthly newsletter, *Interference*. With an emphasis on encouraging member involvement, president Dan Milojevich provides updates on club meetings and events. In "Ken's Pen" and "Tom's Tips," senior advisor Ken Meade and newsletter editor Tom Crowley share their flight experiences, hints and techniques.

Like *Model Airplane News*, *Interference* challenges readers with a monthly "Name that Plane" contest. The first member who can identify the illustrated mystery aircraft at the following meeting wins raffle tickets. The raffles—which offer exciting prizes, such as ready-to-fly planes, including radio and engine—help to raise money to maintain the club's flying field.

Photographs published in the "Pics" section celebrate the club members' participation and accomplishments. Readers can check out highlights of club events as well as attractive, award-winning models.

A helpful calendar lists a variety of contests and events for each month. The newsletter also covers local museums and other sources of airplane history and information. And for those who are new to the R/C flying world, the club offers pointers from 11 instructors. Meetings are held every second and fourth Tuesday, and guests are always welcome.

To the San Gabriel Valley Radio Control League we award two subscriptions to *Model Airplane News*. Keep up the good work!

ADVERTISER INDEX